MODELLING REGIONAL FLUCTUATIONS OF THE NEW YORK STATE ECONOMY

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MODELLING REGIONAL FLUCTUATIONS OF THE NEW YORK STATE ECONOMY

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This [k1][k2]dissertation examines employment fluctuations in New York State, and the inter-relationship between employment of New York State and that of the US. New York State suffered more severe downfalls during the economic recessions of 1991 and of 2001, compared to the national experience. To understand these rapid economic fluctuations of New York State better, the dissertation addresses the following questions: (1) what are the determinants of employment growth? (2) how did export grow in New York State? (3) how do NYS industries differ in terms of trade-related factors? (4) are there permanently common components between NYS employment and US employment fluctuations? and (5) how did each industry sector contribute to total employment fluctuations in New York State?

Using cross-sectional analysis of 51 states, the study finds that export growth may explain employment growth with the same magnitude as the domestic demand potential. Shift-share analysis suggests that the industry mix effects appear as the main source of regional competitiveness in export growth. The dissertation also examines the relationship between New York State and US economic fluctuations by decomposing common trends and cyclical components with VECM. The result indicates a single co-integrating relationship between employment in NYS and in the US, suggesting that NYS and US employment appear to have common trends.

The dissertation finally uses various VAR models to analyze sectoral

fluctuations in New York State employment. The main points of inquiry are the contribution of each sector on regional employment, the role of regional export, and the possible interaction between each industry sector. The estimation result suggests that NY State shocks are more important than US shocks in determining NY State employment. It finds that the contribution of NYS export is relatively small and the cross-industry effect does not significantly affect the analysis. In general, sectoral analysis of NYS employment is more sensitive to the time period chosen than to addition of NYS export effect and cross-industry effect. National shock becomes more important after recession than before recession. This is more conspicuous in some industrial sectors such as manufacturing, education and health, information, government, and finance.

BIOGRAPHICAL SKETCH

Geun-Won Ahn earned his Bachelor's and Master's degrees in Urban Engineering from Seoul National University, South Korea in 1991 and 1993 respectively. His Master's thesis - *The Effect of University Enrollment Policy of the Capital Region on the Population Dispersal* - was published by Seoul National University: Following graduation he worked as an urban planner in the Kumho Engineering Company of South Korea.

After 6 years of work experience, he began graduate work in the field of Regional Science of the Department of City and Regional Planning at Cornell University, receiving a . Special Master's in 2005. Finally, he completed the Ph.D degree in Regional Science in 2008.

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During the years of Cornell, many others helped and influenced me in various ways. I am grateful to all of them; too many to name – especially colleagues, seniors and juniors from South Korea and friends of the Korean church.

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Chapter 1.

Introduction

The economy of New York State (NYS) was more severely affected by the economic recession of the 1990s and early 2000s than the nation as a whole, with figures for total employment showing rapid falls compared to the only slight decreases exhibited by the rest of the nation. From July, 1990 to March, 1991, and from March 2001 through November 2001, employment declined 2.9 % and 2.3% in New York State, whereas the nation declined 1.1 % and 1.2 %, respectively. This unusually high and rapid rate in total employment decline attracted considerable attention*s*.

Studies on regional economy have beenfocused on how different regional economic growth responded ingdifferently to various shocks. Shocks in the economy tend to have a larger impact on regional than on national economies, while local economies are related to the national economy in various ways. Although most economists agree that such differences among states exist, the nature of these differences is not well understood. It is often considered that regional industry is the major sources of different regional economic growth differences. The rRegional manufacturing base is one of most important factors affecting different regional responses to economic shocks. Naturally, many studies have analyzed regional industry growth, the sources of it, and the role of the industrialy sector into regional economic growth.

Difficulties in analyzing industry growth arise, however, because sinceindustry sectors tend to move together, and it is hard to tell . It is not certain which industry sector is affecting s regional growth rate. An eExport base model provides one explanationon it, suggesting that export industry creates exogeneous demand in relation to other sectors. Other concerns focus on cointegration of two different

sectors. When different sectors move together, it often indicates that there is co-movement between two sectors, consisting of common trends and cyclical components.

1.1 New York State Economic Profile

As of 2005, the population of New York State was 6.5% of the national population. Although the population of the State had been increasing, the ratio to the national population had been slightly decreasing. The population of NYS is racially and ethnically diverse, having the second highest immigrant population share among the six states with the most immigrants. Table 1-1 provides an overall profile of NYS.

The New York State earnings were 7.9% of national earnings in 2005, decreasing when compared to national earnings. Per capita personal income of NYS was 117% of the national per capita income. New York State has very high average incomes and wages relative to the US, while median incomes and wages are only modestly higher than the national standard. Recently, however, median family income in New York State improved moderately.

New York State also has a low unemployment and high labor force participation rate. The economy of NYS relies more heavily on education, health services, and finance than the national economy overall. The State's recent economic performance had been showing signs of economic expansion: strong economic indicators for real personal income, total wages and salaries, payroll employment, and gross domestic product. Professional services, finance, construction, health and social services, and higher education particularly contributed to the recent recovery. On the other hand, manufacturing job losses were widespread and deep. Among those still not performing well are wired telecommunications, wholesalers, and securities.

Table 1-1. New York State Economic Profile

	1990	1995	2000	2005
Population (millions)				
NY State	18.0	18.5	19.0	19.3
US	250	266	282	297
NY / US	7.2%	6.98%	6.74%	6.5%
Per capita personal income				
NY State	$ 23,523	$ 27,082	$ 34,895	$ 40,916
US	$ 19,477	$ 23,076	$ 29,843	$ 34,685
NY / US	121%	117%	116%	117%
Earnings (millions)				
NY State	$ 333	$ 390	$ 539	$ 632
US	$ 3,702	$ 4,662	$ 6,505	$ 7,978
NY / US	8.9%	8.3%	8.2%	7.9%
Employment (millions)				
NY State	9.8	9.6	10.5	10.8
US	139	149	167	174
NY / US	7.1%	6.4%	6.3%	6.2%
Manufacturing earnings				
NY State	$ 38	$ 38	$ 42	$ 44
US	$ 636	$ 756	$ 960	$ 1,011
NY / US	5.97%	5.03%	4.4%	4.4%
Finance and insurance earnings				
NY State	$ 43	$ 58	$ 100	$ 108
US	$ 219	$ 289	$ 473	$ 609
NY / US	19.6%	20.1%	21.14%	17.7%
Health care and social assistance				
NY State	$ 29	$ 40	$ 48	$ 62
US	$ 315	$ 432	$ 549	$ 741
NY / US	9.2%	9.3%	8.7%	8.4%

New York State suffered a longer recession than the nation in 1970s and 1990s, while its economic recession coincided with the nation in 1980s. As shown in Figure 1-1, the regional economy suffered a deeper and bigger impact of the economic shocks.

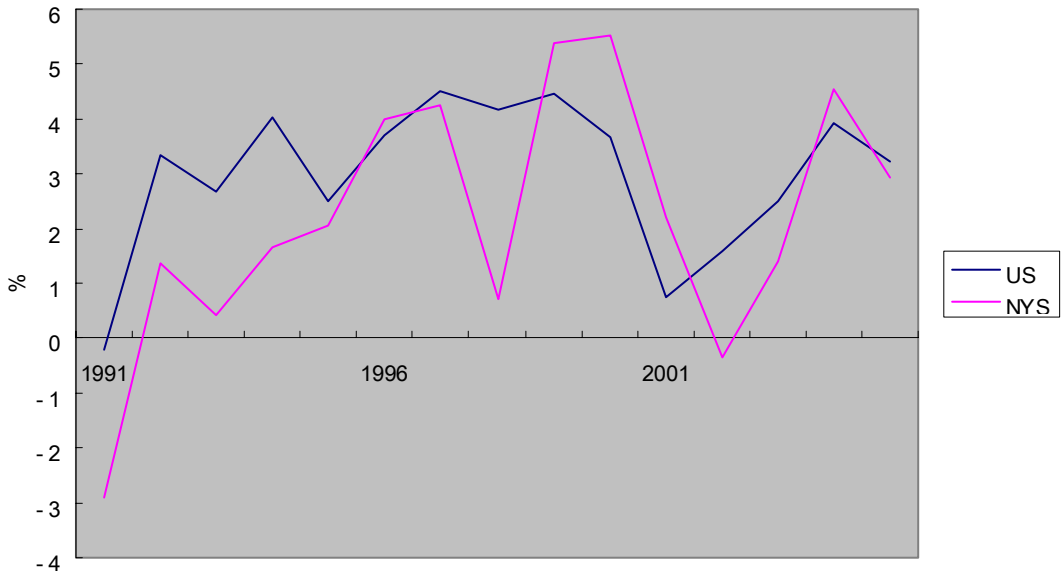

Figure 1-1. GDP Growth Rate of NYS and US

As seen in Table 1-1, manufacturing earnings in the state increased only slightly from 38 million dollars in 1990 to 44 million dollars in 2005, while total state earnings increased from 333 million dollars in 1990 to 632 million dollars in 2005. The share of manufacturing earnings to national earnings, thus, decreased from 1990 to 2005. The share of manufacturing employment to total employment had been continuously decreasing both in the nation as a whole, and in New York State.

Table 1-2 presents the growth rate of total employment of NYS and the US. From 1990 to 2005, total US employment grew at 1.67% annually, while that of NYS

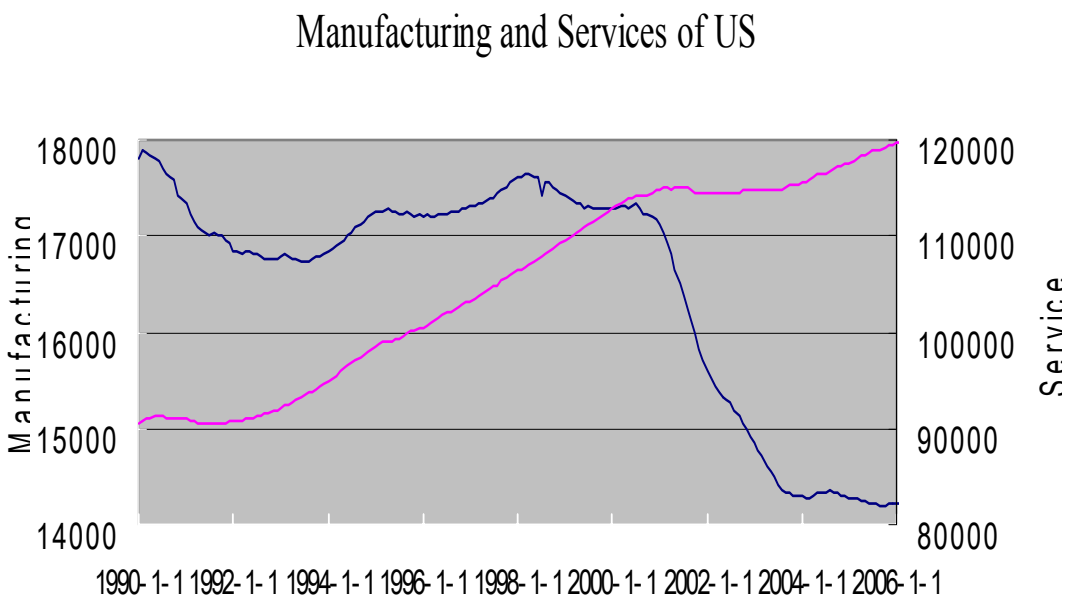

Figure 1-2. Manufacturing Employment of US

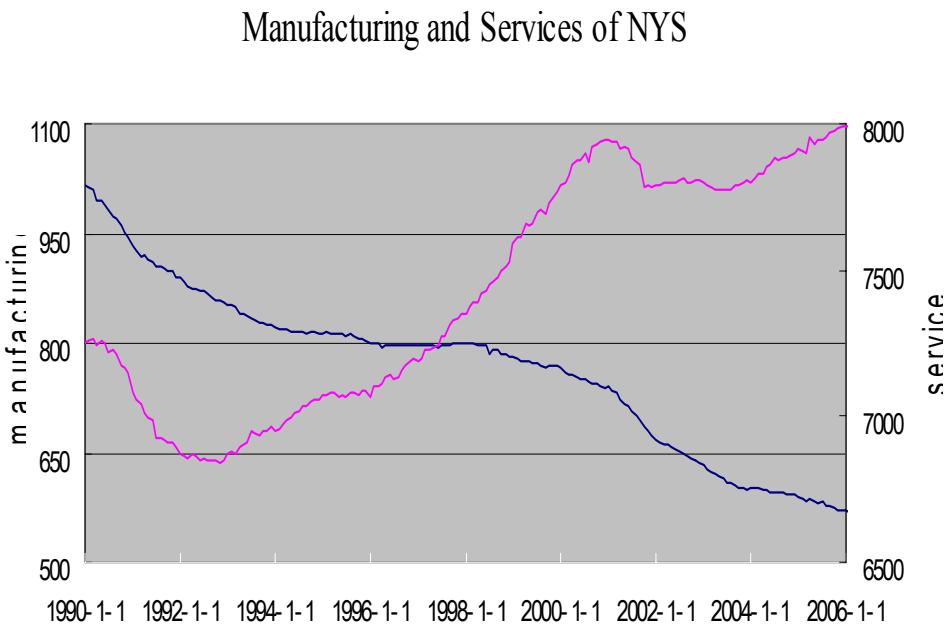

Figure 1-3. Manufacturing Employment of New York State

grew only at 0.33% annually. For the same period, US manufacturing employment of US declined by 1.31% annually, while that of New York State declined by 2.69% annually. The Employment in the manufacturing sector may play an important role in explaining the regional fluctuations. The relationship across business cycles changes rather dramatically both in relative amplitude and duration. Although the manufacturing employment in the US and New York State in Figure 1-2 and 1-3 shows an overall decrease, the trend is more obvious in NYS, consistently slowing down while the service industry grew.,

Table 1-2. Total and Manufacturing Employment of US and NYS (thousand)

	Total Employment			Manufacturing Employment		
	1990	2005	Annual Growth Rate	1990	2005	Annual Growth Rate
US	106,312	132,929	1.67 %	17,755	14,260	-1.31 %
NYS	7,999	8,395	0.33 %	969	578	-2.69 %

Figure 1-4 shows that the relative ratio of NYS total employment to US total employment declined continuously to nearly 6.2% in 2005. The same pattern also applies to the trend of manufacturing employment (see Figure 1-5).

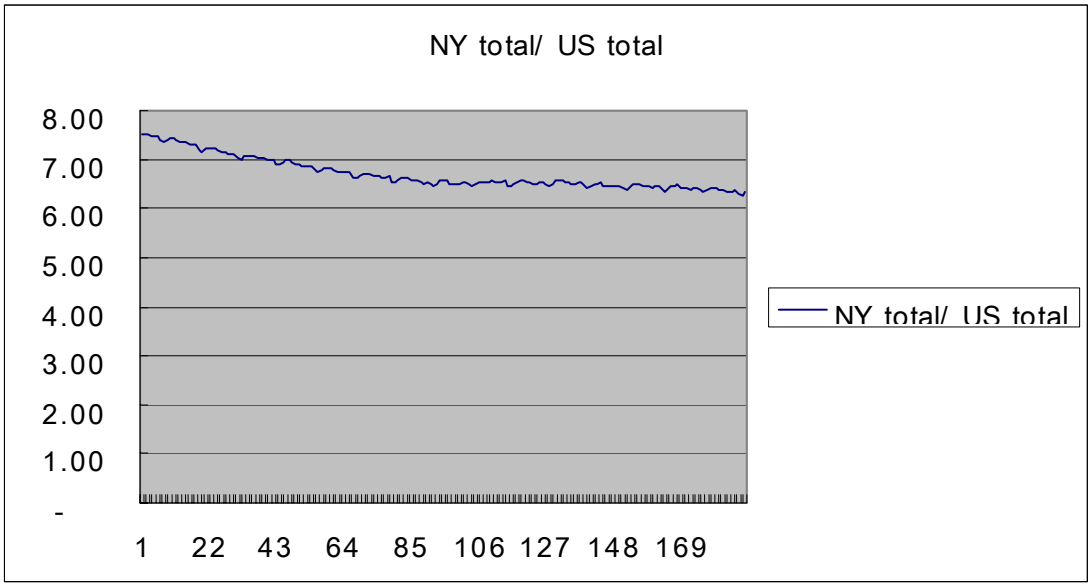

Figure 1-4. Relative Ratio of Total Employment between NYS and US

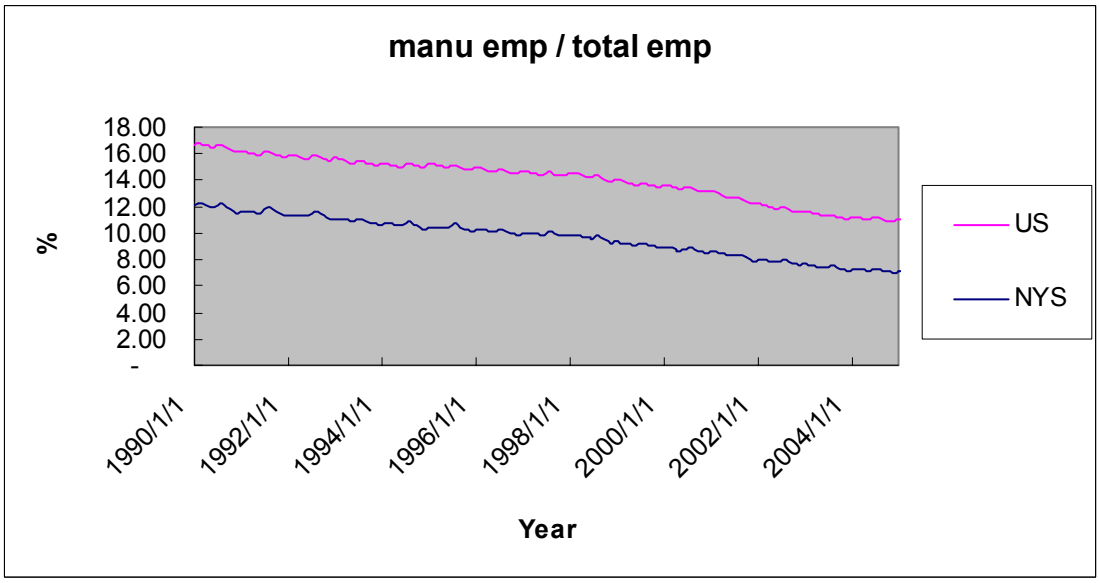

Figure 1-5. Relative Ratio of Manufacturing Employment to Total Employment

1.2 Regional Business Cycle in New York State

New York State's recessions tend to last longer than the nation's. During the 1990-1991 recession, New York State experienced economic downturns earlier (in 1989) which lasted longer (until 1992). The structure and the sectoral composition may explain such a trend.

Recession in upstate New York has clearly differed significantly from national ones in both timing and duration. In general, upstate metropolitan areas have tended to experience longer recessions than the country as a whole. Binghamton and Utica, the relatively small metropolitan areas, have seen especially frequent recessions and volatile growth. Each of New York State's metro areas has a distinct industrial composition, leading to different business cycles.

In the major upstate metro areas, the labor force and the number of unemployed are growing faster outside the cities. Although there was no net job growth in the major upstate metro areas from 1990 to 2000, there was a massive net job shift from the large cities to the suburbs and outlying areas. Movements in the six major upstate metropolitan areas during the 1975-2001 period showed these phenomena clearly. Albany's economy has grown the most since 1975, while Buffalo's and Utica's the least. The economic performance of Syracuse, Rochester, and Binghamton falls somewhere in between. A fairly steady growth was evident in all upstate metro areas throughout the 1980s, followed by much flatter growth in the 1990s. Buffalo and Rochester metro areas show the industrial restructuring between 1960s and 1990s, i.e., declining manufacturing and rising service industry. The loss of jobs was pronounced, while both areas maintained specializations in a number of key manufacturing industries. The demand for high-level services rose for the period particularly in traded services. Both cities had similar successes in consumer services - particularly health and education - but they differed in the performance of

the producer services sector. Buffalo established strength in financial producer services such as commercial banking and mortgage brokerage, while Rochester excelled in non-financial producer services such as communications and computer and data-processing, and grew faster in producer services. Although the economies of both metro areas have centered on manufacturing, the restructuring from manufacturing to service has differed.

1.3 Economic Diversity and Its Volatility of NYS Economy

There has been long debate on whether diversity in regional industry or specialization in a few key industries is better for a regional economy. Although there is no agreement whether one is better than the other, researches (Glaeser et al, 1992, Quigley, 1998, Deitz, 2001) indicates that diversified economies grow faster than those concentrated in select industries. Diversity can be a spur to productivity and innovation; firms in a region with many types of businesses will enjoy easy access to the resources and services needed for production. Also, regions with a broad mix of industries possess a buffer against economic shocks that adversely affect individual industries. Indeed, more diverse economies experience less volatility than economies with concentrations in a small number of key industries.

According to Deitz and Garcia (2002), the New York State economy ranked as the seventeenth most diverse state in the country from 1996 to 1997; . New York's overall level of industrial diversity, 0.79, exceeded the national average of 0.68. The level of diversity also differed among regions in the state. The most diverse county economies were those centered in Long Island, Buffalo, and Syracuse. Employment in these economies is distributed broadly across different industries. New York States' least diverse economies are those in Rochester, Niagara Falls, Binghamton, and Utica. These economies have employment concentrated among

fewer industries and a considerable number of workers employed by large companies.

A particularly interesting phenomenon was found in Buffalo and Syracuse, where often thought of as highly concentrated in manufacturing. As the manufacturing sector has shrunk in recent decades, the industries that remain have gained a greater share of total employment. The composition of these economies is now much more varied, and much closer to the national composition. Thus, much of New York State's gain in industrial diversity has stemmed from the job cutbacks that occurred in its once-dominant manufacturing industries.

The US economy is less volatile today than it has been in the past. Recessions tend to be shorter, expansions longer, and output and employment are generally more stable. The US economy has also become more stable in terms of the differences in job growth between the states. These differences have become smaller as state employment growth rates have converged. Although there is a positive association between growth and volatility for a few of the fastest growing states, there is no broad correlation between volatility and growth. In the case of NYS, it has been shown that the diverse industry composition has made it the most stable economy in the nation (Deitz and Garcia, 2003).

1.4. Economic Growth in Industry Level

Economists have long debated for long about how government policies and other aspects of the business environment contribute to growth, and what policies should therefore be advocated. Labor utilization, technological progress, and prudent macroeconomic policies, including low inflation, have all been considered necessary for growth. High levels of taxation and government spending seem to affect growth both directly and indirectly through investment. A one percentage point increase in the overall tax rate amounted to a decline in the level of output of about 0.6-0.7% (OECD

2004). Spending on R&D can have a substantial effect on both the level and the rate of growth of total output, and that education and training play a key role in explaining differences in growth performances (Krugman, 1991). Moreover, a high degree of exposure to foreign trade was also found to have a significant positive impact on output growth.

An industry-level analysis sheds further light on issues that the macro-level analysis may fail to capture, such as the effects of specific policies like trade restrictions on industry performance. Likewise, differences in growth patterns at the industry level may also point to variations in the context to which regions are benefiting from broader economic changes, or from the potential offered by new technologies.

From a firm-level perspective, a large fraction of aggregate labor productivity growth is driven by what happens in each individual firm, while shifts in market shares from low to high productivity firms seem to play only a modest role. OECD (2004) specifies a high correlation between entry and exit rates across industries, what they call calling a process of 'creative destruction', in which a large number of new firms displace a large number of inefficient firms.

1.5. Motivation for the Dissertation

The reason why the New York State economic slows- downs were deeper and longer than the nation overall can be explained by various factors. Traditional export base theory suggests that foreign exports are an engine of economic growth. Direct and indirect multiplier effects associated with export expansion represent a driving force generating regional economic growth. An autonomous rise in export demand leads to growth in regional income which, in turn, increases local demand causing additional income growth, and so forth.

Endogenous growth theory provides an explanation for economic growth based on the existence of externalities associated with investment in knowledge, human capital, and new product development. The central idea is that development of new products for export provides externality benefits, and that each product has a different potential for spillovers. The mechanism through spillover varies, such as investment in R & D, new product inputs, or learning-by-doing.

Along with the theoretical debates, the question of export-growth linkage has received much attention within the empirical literature at both the national and regional levels. At the state or regional level, two distinct aspects have received particular attention: interregional export and international export. Studies focusing on the interregional exports of states typically involve application of export-base theory to the question of whether a region's export sector drives non-export activity. (Nishiyama, 1997) Studies of state international exports consider the impact of foreign exports on state or regional economic growth. (Erickson, 1989) Also, the importance of foreign versus domestic markets raises *the* questions about the source of economic growth.

In this context, sectoral decomposition of the NYS economy may provide a more solid basis for understanding fluctuations in the State's economy and major

sectors affecting it. The tendency of employment to co-move positively across industry categories is a feature of national business cycles. However, much less is known about the degree of co-movement at state or regional levels. Local economies are clearly influenced by aggregate and sector-specific shocks. Moreover, propagation mechanisms that transmit shocks across sectors at the national level also operate at the regional levels. Influences specific to states and to particular sectors within states can intervene to alter cyclical behavior relative to that observed for sectors at the national level. The magnitude and timing of fluctuations in business activity can vary across states and sectors.

In order to better understand these phenomena, multi-sectoral disaggregate investigation into the sources of employment fluctuations in New York State could be performed. For the purpose of decomposing national, regional, and industrial components, I would utilize a structural VAR model, which is a modified shift-share model in a more general framework containing orthogonal elements of employment growth, following Coulson (1999).

This paper explores the inter-relationship between economic indicators in New York State and its national counterparts. It compares the State's performance in recent years with that of the nation, and assesses the importance of national and local developments for the New York State economy. A cursory examination of the economic indicators suggests that employment growth over the last sixteen years has been very poor, both in absolute terms and relative to the nation, suggesting a region in decline.

The paper consists of 6 chapters. Chapter 2 reviews the previous literature on business cycle and economic fluctuations. The third chapter analyzes internal and external factors affecting New York State's economy. Chapter 4 examines the relationship between New York State and US economic fluctuations, decomposing

permanent and temporary proponents. Chapter 5 analyzes sectoral fluctuations in the State's employment growth. The final chapter, Chapter 6, summarizes and concludes.

Chapter 2

Literature Review

Between the Great Depression of the 1930s and the 1960s, economists paid considerable attention to business cycles, but as Keynesian aggregate demand policy based on the 'Phillips curve' proved effective, the concept of 'business cycle' disappeared from economists' interest. Economic booms in major developed countries, and the impact of the Vietnam War, may have played partial roles in recovery of the world economy as a whole. In the 1970s, however, the occurrence of stagflation, inflation under economic slump, demonstrated the limits of Keynesian policy prescriptions. With the advent of the rational expectations hypothesis, in which economic agents are expected to act rationally, economists renewed interest in the business cycle, but at the turn of the 21st century, despite progress in theoretical realms, no consensus has yet been reached as to its explanatory viability.

One of the most important questions in macroeconomics is what causes macroeconomic fluctuations. Although the terms economic fluctuation and business cycle differ in any strict sense, in actuality they are used interchangeably. Business cycle can be defined in various ways, but it essentially means that while aggregate economic time series have no particular cycle, they tend to fluctuate in the same direction repeatedly. Depending on how business cycle is defined, two classes of research have been developed. One studies cycle, amplitude, reference cycle and turning point within an historical context. The other looks to impulse and propagation mechanisms to explain stylized facts that have occurred during the process of business cycle. Impulse mechanism means outside shock influencing the economy, and propagation mechanism means the process by which this outside shock spreads to different sections in the economy.

Two important hallmarks of the business cycle are auto-correlation and co-movement. Co-movement, in which the economy expands and contracts together over many sectors, may provide the foundation for the presence of outside shock (especially aggregate shock) in an economy. Because of it, business cycle theory can be classified depending on the kinds of this outside shock.

It is important to understand the development process of business cycle theory in order to carry out studies in this area. Because theories have been developed to explain actual stylized facts under the special circumstances of the economy, it is equally important to understand the development process of analytic tools used to understand business cycle. Tools for assaying economic phenomena, for example, have made it possible for things that were only understood notionally in the past to be analyzed empirically.

2.1. Evolution of Business Cycle Theory

As the evolution of macroeconomic theory involves Keynesian and Classical schools, business cycle theory as one of main parts of macroeconomics also follows two main streams of thought. Until the outbreak of the Great Depression in 1930s, economists following classical macroeconomic paradigms believed that markets always clear because the economy has self-correcting mechanisms, and naturally they did not pay much attention to business cycle. With the failure to explain mass unemployment arising from the Great Depression, Keynesians advocated aggregate demand theory. Supported by Hicks (1937) in theory, and Philips (1957) in empirics, Keynesian aggregate demand theory had been used mainly as a macroeconomic analytic tool until the late 1960's. The Keynesian view of business cycle is that it results from failure of market clearing. Monetarists such as Friedman and Phelps, however, believe that it is not the failure of market clearing that causes real output fluctuations around

natural rates of output, but different expectations of economic agents. They do not agree with Keynesian price stickiness, and suggest that its choice theory lacks microeconomic foundations.

To the contrary, Lucas used a rational expectation model instead of monetarist's adaptive expectation models, and argued that business cycle occurs because of imperfect information on the assumption of market clearing. In other words, business cycle occurs as the result of economic agents' optimal behavior in the face of unprecedented price fluctuation. However, 1970's stagflation deprived Keynesian business cycle theory, with its emphasis on aggregate demand fluctuation, of its persuasive power. Real business cycle theory as espoused by Kydland & Prescott (1982) and Long & Plosser (1983), in which business cycle comes as the result of economic agent optimal behavior when faced with unprecedented aggregate supply, has expanded steadily. In contrast to the stream of anti-Keynesian business cycle theory such as that pursued by monetarists, rational expectation and real business cycle theory, a new Keynesian theory has been developed which describes business cycle on the basis of Keynes' basic supposition and optimal behavior of economic agent following rational expectation. Together with real business cycle theory, this forms the main stream of current thought.

Business cycle theory itself can be classified according to several aspects. Depending on whether the cause of business cycle is an exogenous factor occurring outside of the economy or an inside structural factor, it can be classified into exogenous business theory and endogenous business theory. Exogenous business theory says that the economy has basically a stable structure, but exogenous shocks such as technological changes (real business cycle theory) and policy changes (monetary business cycle theory) are delivered to the overall economy through its propagation mechanism, and cause fluctuations in important economic variables like

GNP. Meanwhile, endogenous theory argues that because an economy is essentially not stable, without external economic shock, business cycle happens of itself because of economic agent behavior.

Endogenous business cycle theory can be further classified into sun-spot theory and increasing return theory. According to the sun-spot theory, since economic agents have certain expectations of the future of the economy, when their first expectation is realized (called self-fulfilling prophecy), this leads to business cycle. (Grandmont(1985), Azariadis(1981) and Azariadis & Guesnerie(1986)) Increasing return theory, also called endogenous growth theory, says that business cycle is caused by increasing returns to scale which result from the external effects of accumulated knowledge and technology. (Romer(1986,1989), Murphy, Schleifer & Vishny(1989) and Lucas(1988))

Exogenous business cycle theory can be classified into monetary business cycle theory, real business cycle theory and new Keynesian business cycle theory. Initiated by Friedman (1963), monetary business cycle theory explains the cause of business cycle as nominal shocks such as monetary shocks. Nominal shocks increase regional price and average price level, and economic agents with imperfect information misunderstand these increases as increases in relative price, changing labor supply and output level. (Lucas(1973), Sargent & Wallace(1975))

However, in the case of the United States, the Federal Reserve Bank announces money supply every week, making the supposition of imperfect information erroneous. In addition, monetary business cycle theory has only limited value for explaining auto-correlation, which is one of the major features of business cycle. As a result, real business cycle theory and new Keynesian theory began to dominate monetary business cycle theory.

Real business cycle theory has developed in response to monetary business cycle theory's failure to explain auto-correlation of business cycles, even though it can provide explanations for joint changes among characteristics of business cycle. According to this theory, business cycle is caused by real shock, such as the changes in preference, productivity, technology and the price of raw materials as they interact with economic agents' optimizing behavior.

Real business cycle theory can be classified depending on how it is approached. The representative studies following Walrasian's approach are Kydland & Prescott (1982), Long and Plosser (1983), King and Plosser (1984). Using one-sector real business cycle model, which has only technological shock, without monetary sector or government sector, Kydland and Prescot show that a simulation model with interaction among economic sectors can trace circulative features of time-series in the United States after World War II. Long and Plosser (1987), Norrbin and Schlagenhauf (1988, 1990, 1991), and Altonji and Ham (1990) also study a multi-sector equilibrium model. Meanwhile, open economy real business theory (or trade business cycle theory) suggests that each country's major economic variables show joint movement because of economic interdependence through trading or exogenous shock (world shock), which affects production of all nations in common. (Stockamn(1988), Dellas(1986), Costello(1993), Yoo(1990) and Canova and Dellas(1993)). Using a non-Walrasian approach, Lilien (1982) posits that most of the changes in unemployment of 1970s in the United States were caused by unusual structural shifts, with more demand for products than service.

These monetary and real business theories are also called equilibrium business cycle theory because the market always clears even in the process of business cycle. On the other hand, since equilibrium business theory is unable to explain involuntary unemployment existing in reality, the new Keynesian approach has tried to explain

business fluctuations caused by inflexibility of the price and failure of the market clearing. Using buffer stock theory, in which exogenous shock influences the economy over several periods through changes of stock, Blinder and Fischer (1981) argue that monetary shock changes real output, and Fischer (1977) claims that exogenous shock, such as a monetary shock, changes real output levels due to price stickiness caused by long-term employment contract.

2.2. Economic Shocks and Propagation Mechanism

Some economists assert that exogeneous shocks in the economy lead to business cycle. Pigou (1927) classifies the factors affecting changes in industrial output as impulse*s* mechanism and propagation mechanism. Frisch (1933) also analyzes the causes of exogeneous shocks and the propagation mechanism of the shocks, using an econometric framework.

One of the important concerns in recent macroeconomics is to empirically find the causes of fluctuations in macroeconomic variables. Researchers who emphasize the importance of aggregate shock, such as Lucas (1972), and Kydland and Prescott (1982), suggest that only aggregate shock causes fluctuations in output, although there is no consensus regarding how many aggregate shocks there are in the economy. On the other hand, researchers who emphasize the importance of sectoral shocks, such as Long and Plosser (1983), suggest that sectoral shock can cause fluctuations in the level of output.

Regarding propagation mechanism, the following three topics are considered important. The first topic is the major factors of economic fluctuations. The general view on this is that nominal shock and real shock are the main factors of business cycle. However, since the economy consists of various sectors, and business cycle can occur as a result of interactions among sectors, industry-

specific shock and sector-specific shock may possibly be factors affecting changes in sectoral output and aggregate output. For example, advances in the automobile industry affect various other industries, increasing aggregate output, which is the aggregation of the sectoral output. The theoretical and empirical studies on sectoral shock were initiated by Long and Plosser (1983). Long and Plosser (1983) set up a multi-sector model consisting of six sectors which has only uncorrelated sectoral shocks without aggregate shocks, finding that sectoral shock itself can lead to fluctuations in aggregate output. Extending it, they (1987) also empirically analyze growth rate of output level by industry and find that aggregate shock does not play an important role.

The second topic is the number of aggregate shocks affecting the economy as a whole. Some feel that there is only one aggregate shock, and others that there are more than one shock. The third topic is whether aggregate shock can explain fluctuations in both sectoral output and aggregate output. Nowadays the main empirical question focuses on the relative importance of various shocks, such as sectoral shocks as well as aggregate shock.

2.3 Number of Economic Shocks

Another concern of macroeconomists is how many kinds of shocks there are in an economy. Some theorists argue that there is one aggregate shock, others that more than one aggregate shock is present. Among views advocating one aggregate shock there are various theories on the characteristics of aggregate shock. Monetarists emphasize real shock and the passage of the shock. Lucas asserts that business cycle occurs as an economic agent maximizes utility and profits under imperfect information. With an island economy, decisions of economic agents are based on changes in relative prices between general price and regional price, and the supply changes

depending on expectation (the Lucas Supply Function). When real shock drives regional price levels to increase, the economic agent increases labor supply, and output level in the economy increases. The Lucas model, while it does explain co-movement of price level, production, and employment, has drawbacks in that it cannot explain serial correlation of important macro time series.

On the other hand, real business cycle theory emphasizes the importance of real shock. Lilien (1982) suggests that abnormal structural changes, such as changes in demand of goods relative to the demand of services, brought employment fluctuations in the Untied States in 1970s. Durlauf (1989) suggests that it is dynamic coordination failure of price adjustment that equilibrates demand, and that supply causes economic fluctuations.

There are several theories that argue for more than one aggregate shock. Blanchard (1989), and Blanchard and Quah (1989) suggest that aggregate shocks consist of aggregate demand shock and aggregate supply shock, and that aggregate demand shock mainly explains short run fluctuations of GNP while aggregate supply shock mainly explains long run fluctuations. Blanchard and Watson (1986) suggest that government expenditure, monetary policy, and supply shock cause business cycle. Shapiro and Watson (1988) further decompose economic shocks into demand side shocks, such as shocks on the money market and consumer goods markets, and supply side shocks, such as shocks on labor supply, technological shock, and oil shock.

2.4. Dichotomy between Growth and Business Cycle

The other important concerns in business cycle theory are long-term trend and dichotomy between trend and cycle. Some define *s* real output level with a deviating linear trend line as business cycle. This definition of business cycle has led conventional thinking on the dichotomy between high-frequency business cycle

fluctuations and low-frequency growth fluctuations. In other words, business cycle occurs as temporary shocks, such as monetary policy and government expenditure, are delivered to each sector*s* of the economy. Growth fluctuations proceed slowly, not affecting short run fluctuations of economic variables.

Most traditional research decomposes growth and trend using deterministic trends[?]. However, Nelson and Plosser (1982) argu that, in many cases, a long term time series can be described as a stochastic trend or random walk, and approaches using deterministic trend may not be appropriate. They suggest that innovations in stochastic trend can explain short run fluctuations as well as long run fluctuations in important economic time series such as real GNP. King, Plosser, Stock and Watson (1987) suggest that even temporary economic fluctuations are caused by long-term factors such as technological advances, population growth, and capital accumulations, rather than by short-term factors. They further suggest that technological advances affect steady state levels of capital, and business cycle occurs on the way to adjusting toward steady state. These theories on real business cycle use models based on neoclassical growth theory, denying dichotomy between long tern trend and short-term business cycles since the same shock causes them.

Also, recent studies found permanent components of economic shock in real GDP (Blanchard (1989), Blanchard and Quah (1989), Shapiro and Watson (1988)). For example, Blanchard and Quah (1989), and King, et al (1987) estimate the importance of permanent components of the shock using forecasting error variance decompositions. Various methods can be used to identify the permanent component. Blanchard and Quah (1989) identify the permanent component by assuming that shocks on the supply side permanently affect output level, but do not affect unemployment permanently, while shocks on the demand side have only a temporary

effect. This is identical to the view*s* that only real variables affect long term trend of GNP.

Contrary to this, King, et al (1987) argue for a permanent component, assuming that a permanent component in production is also permanent in consumption and investment. The motivation for these studies lies in estimating relative importance of aggregate supply shocks and aggregate demand shocks. They conclude that, either way, a permanent component of the shock plays an important role in explaining the short run GNP fluctuations that are related to business cycle.

2.5. Aggregate Shock and Sectoral Shock

Most of the earlier studies on business cycle focused on how shocks in the economy affected business cycle rather than how they are delivered, discussing how aggregate shock can explain the changes in aggregate output with a one-sector model. In other words, aggregate shocks, such as nominal shock in the demand side and real shock in supply side, are major factors of business cycle. However, when considering how the shocks are delivered to the economy, it is doubtful that aggregate shock fully explains changes in sectoral output and aggregate output. Since the economy consists of many sectors and business cycle is possibly caused by interactions between sectors, not only aggregate shock affecting every industry in the economy but also industry-specific shock or sector-specific shock can be factors of changes in aggregate output. The occurrence of sectoral shock, such as changes in technology or demand, is delivered to other sectors, affecting output. For example, positive sectoral shock in one particular sector increases individual wealth for those who participated in that particular economic activity, increasing his/her demand for consumption goods and investment goods. Increases in demand for consumption goods leads to changes in consumption and production.

More recent studies began to analyze the importance of sectoral shock theoretically and empirically. Using a multi-sector model, Long and Plosser (1983) suggest that, without aggregate shock, sectoral shock itself means business cycle in aggregate output. Extending their earlier model, Long and Plosser (1987) empirically analyze the relative importance of aggregate shock and sectoral shock. They suggest that the role of aggregate shock is not as important in explaining growth rate of output by industry, while the role of sectoral shock is more important for industrial changes. In explaining changes in industry output at the aggregate level, however, aggregate shock explains 47% of such changes, while sectoral shock only partially explains aggregate industrial changes. They conclude that not only aggregate shocks but also sectoral shocks are important factors in business cycle.

Romer (1991) analyzes how aggregate shock can explain sectoral changes. Using factor analysis, he suggests that aggregate shocks affect manufacturing sectors with greater magnitude compared to agricultural sectors. Norrbin and Schlagenhauf (1988,1990,1991) decompose economic shocks into aggregate shock, region-specific shock and industry-specific shock, analyzing how each can explain business cycle. Using a multiple indicator cause model (DYMIMIC), they show how each shock can explain business cycle in a statistically significant way, concluding that sectoral shocks as well as aggregate shock also need to be considered in explaining business cycle.

Other literature studies the importance of several shocks in an open economy. Stockman (1988) assumes that three factors affect changes in industrial output for seven European countries and the United States: one that affects a particular industry for all countries; one affecting all industry for a particular country; and other special factors. Estimating the importance of these factors, he concludes that all three *factors* are important. Krieger (1989), similarly examining shocks affecting one

particular country, shocks affecting a particular industry, and shocks affecting both particular country and particular industry, suggests that these factors explain changes in aggregate output and industrial output. Altonji and Ham (1990) also decompose economic shocks as national shock, industry-specific shock, and region-specific shock, suggesting that these explain changes in aggregate output. The strength of their argument lays in the pioneering nature of their study, which offers a methodology for investigating the degree of aggregate shocks and disaggregate shocks in determining variation of employment growth at the national, regional, and industrial levels. Using annual data from 1961-82 on Canadian employment at the industry-province level, and regarding national employment growth as dependent on US growth, lagged Canadian growth at the national, industrial, and provincial levels, and shocks specific to nation, industry, province, and industry-province pair, they emphasize (1) the random fluctuations in the levels of disaggregate shocks inducing variation in aggregate employment; and (2) the relative contributions of disaggregate and aggregate shocks affecting particular industries and regions. Their conclusions are that US shocks are the major source of national employment growth variance, while Canadian shock accounts for a quarter of this variance. Industrial shocks appear to play an important role in several industries, while provincial shocks play an important role in most provinces. However, disaggregate shocks, both industrial and provincial, account for only one-tenth of aggregate variation.

2.6. Sources of Fluctuations

Many studies that examine the sources of fluctuations at both aggregate and disaggregate levels have followed Altonji and Ham (1986). Particularly, studies in this literature consider the importance of national, region-specific, and industry-specific disturbances in fluctuations experienced by a nation and propagation of those

disturbances across regions and industries.[1]

Regional employment variation is naturally a reflection of the sum of employment growth or decline in various industries or the region. Some sectors of the region move in the same direction, while the others do not. Or some sectors grow faster than the regional growth as a whole. Accordingly, to know which sectors are responsible for that growth is indispensable in a regional policy context.

Another factor that makes for employment growth is fluctuations like those in the business cycle literature. The employment fluctuations across U.S. regions appear to be marked by a common component as well as considerable heterogeneity among regions.

A method for isolating the separate contributions of the various regional industries over time is imperative. VAR is a convenient tool for this purpose because it provides a mechanism for constructing innovations in various sectors that are orthogonal to each other, and allow the implementation of a technology for assessing the dynamic impact of these separate shocks. This method is related to shift-share analysis, in that it precludes cross-industry effects except through their impact on aggregate totals. [2]

Before reviewing the literature about employment fluctuations, one study that examined the regional booms and slumps over 40 years in the U.S. should be mentioned. Blanchard et al. (1992) examine how the states adjusted after adverse employment shock by looking at relative wages, unemployment rates and employment rates. Their findings were that employment shocks have permanent effects on the state

[1] For example, see Altonji and Ham (1990), Prasad et el (1998), Clark (1998), Coulson (1999, 2001), Carlino et el (2001), Bhattacharya (2002).

[2] As seen in the shift-share analysis, it was believed that a region's economic performance would be different from the national economic performance only to the extent that industry mixes vary in the region.

growth rate, negating the assumption that the state growth rate returns to the same growth rate at the interstate level, and result in permanently different employment patterns, whereas the relative wage and unemployment rate or shocks on wages and unemployment rate are found to be temporary and steady. Adverse employment shock initially increases unemployment and reduces participation, but the effect disappears after about five to seven years. Nominal wage decreases by adverse employment shock trigger some recovery in employment, but it returns to normal only after about ten years. They conclude that differences in persistent state growth rates result from movements by the firm that triggered movements of workers.

At the metropolitan level, the similar phenomenon could be discovered in suburbanization. Central cities have lost shares of employment and population, whereas suburbs have gained employment and population as metropolitan economies have grown. The relationship between central city and suburb has traditionally been one of substitution in that suburban growth is at the expense of potential growth of downtown. Recent studies, however, have found evidence that the relationship between central city and suburb could be complementary. Chang et el (2001) document that the extent to which such complementary relationship can be found depends on the particular sector and time period that shocks last. In the short run, local shocks have an influential effect on both central city and suburb, but in the long run there are effects across both central city and suburb.

Coulson (1999) uses a VAR method to identify sectoral sources of metropolitan employment growth rate. He decomposes industry growth into national, industrial, regional, and idiosyncratic components, putting the model into a semi-structural vector auto-regression. Precluding cross-industry effects, and allowing cross-industry effects only on aggregate totals, Coulson's approach is related to shift-share analysis. He finds that regional shocks are more influential than national shocks,

and regional manufacturing, service and public sectors have a major impact on local employment growth rates.

Coulson (2001) also used a sectoral-based VAR model to investigate employment growth in Massachusetts. Here he found that local sectoral shocks accounted for employment growth in Boston in the short run, whereas the influence of national shocks increased in the long run. Among industries, the service, manufacturing, and government sectors were the major components affecting sectoral employment growth in Boston. Further, he decomposes important shocks at several historical turning points in Boston employment. For the initial growth periods, shocks in export accounted for metropolitan expansions, but shocks in local industries were major sources for the later employment growth downturn.

Carlino, DeFina, and Sill (2001) examined the industry employment growth in five metropolitan areas, analyzing the impact of aggregate disturbances and local sectoral shocks. Using structural vector auto-regressions (SVARs), they found that industry shocks account for more of the forecast error variance than do aggregate shocks. Among industries, local government, manufacturing, and service sector are major sources of variability.

Chang and Coulson (2001) studied employment fluctuations in four central cities and suburbs, decomposing the sources of shocks into national, sectoral, suburban, central city, and local sectoral components. They find substantial complement effects between central cities and suburbs: aggregate suburban employment affects central city employment, and sectoral shocks in the central city have a positive impact on sectoral employment of the suburban area.

Chapter 3

Internal and External Factors of the New York State Economy

Economic theory suggests several possible interpretations of causality between foreign exports and economic growth. The most pervasive interpretation is rooted in the traditional export base theory that foreign exports are an engine of economic growth (North, 1975). The theory suggests that direct and indirect multiplier effects associated with export expansion represent a driving force generating regional economic growth (Innis 1995, Webster et el 1990). An autonomous rise in export demand leads to growth in regional income which, in turn, increases local demand causing additional income growth, and so forth.

Endogenous growth theory, as developed over the past decade, provides an explanation for economic growth based on the existence of externalities associated with investment in knowledge, human capital, and new product development. International trade models of endogenous growth regard new product development as the driving force behind long-run economic growth (Grossman and Helpman 1991, Young 1991). The central idea is that development of new products for export provides externality benefits, and that each new product or new product group has a different potential for spillovers. The mechanisms through which spillovers occur vary among models. Some models stress the role of investment in research and development (R&D) for development of new goods (Grossman and Helpman 1991) or new productive inputs (Romer 1990), while others emphasize learning-by-doing (Young 1991). The general outcome of each of the trade models is that countries or regions specializing in production and export of products with greater potential for spillovers grow faster than those specializing in products with less potential for spillovers. Because high technology and R&D intensive sectors are thought to have

the largest potential for growth spillovers, export-led growth is expected to be the most pronounced within these sectors.

An alternative hypothesis on the direction of causality between export and economic growth is found in Heckscher-Olin (H-O) factor endowment theory, product cycle theory, and in theories of industry localization, all of which support the notion of reverse causality, whereby export growth is enabled by local or domestic economic conditions. Countries or regions specialize in production and export of goods that are intensive in the factors of production in which each country or region is relatively well endowed. The sources of economic growth within H-O theory stem from the endowments themselves. Export growth results solely from growth in a region's endowments of labor, capital or other factors of production. Domestic supply-side conditions thus drive the growth of exports according to H-O theory.

Product cycle theory, as originally articulated by Raymond Vernon (1966), also supports the idea of domestic-driven export growth. Product cycle theory provides an explanation for production and trade patterns based upon the nature of the domestic market, levels of product demand, external economies of agglomeration, and the existence of market monopoly. Vernon's product cycle theory emphasizes the role of domestic market characteristics[3]. During the first and second stages of the product cycle, which are most applicable to US exports, growth of exports is primarily a function of regional economic conditions. For products in the first stage, such as high technology and R&D intensive sectors, regions with large markets and a dynamic industrial base are most likely to produce innovations which lead to export growth. In second stage industries, which might include, for example, industrial machinery and transportation equipment, regions with relatively lower labor and capital costs draw

[3] The theory suggests that manufactured goods typically follow three general stages of product development: introduction, maturation, and standardization. Each of these stages corresponds to a specific pattern of production and trade.

exporting firms. In either case, product cycle theory suggests that regional economic conditions drive export growth.

Theories of industry localization also support the notion that domestic conditions foster export growth in both the classic tradition of Marshall (1920) and more recent work by economic geographers such as Glasmeier (1988) and Storper (1992). Industry localization stresses the role of external economies of scale in promoting the foundation of specialized industrial agglomerations and in fostering the subsequent growth of exports from these agglomerations[4]. Despite different interpretations of the mechanisms by which industrial agglomerations form, both classic and more recent theories of agglomeration indicate that local, supply-side conditions such as the existence of external economies are the driving force behind regional specialization and growth of exports.

A final hypothesis on the direction between exports and growth is suggested by work in the area of new international trade theory (Helpman and Krugman 1985). The geographical new international trade theory models, as developed by Krugman (1991), and Krugman and Venables (1993), also emphasize the linkages between economies of scale, regional concentration of production, and trade. The theory suggests that there is a two-way causal relationship between exports and regional economic growth, with a strong regional economy promoting exports, and exports, in turn, promoting the regional economy. In emphasizing the role of scale economies in production, new trade theory further suggests that scale-intensive sectors may have a larger potential for feedback relationships between exports and the local economy.

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[4] Classic theories of industry localization account for the agglomeration of specific industries by emphasizing the importance of factors such as access to shared inputs and access to transportation networks. Recent geographical literature on industry localization, which has largely focused on high technology sectors such as electronics, suggests that a number of other factors also promote formation of industrial districts. These factors include technological and organization learning between firms, inter-firm supply linkages, and reductions in transaction costs due to geographic proximity.

Overall, the above trade theories illustrate a variety of possibilities regarding the relationship between exports and regional economic growth. Export base and endogenous growth theory provide support for the view of exports as an engine of growth. Each of these theories suggests that causality runs from exports to the domestic economy. By contrast, factor endowment, product cycle, and localization theories suggest that causality runs from domestic economic performance to exports. Finally, new trade theory suggests that the relationship between trade and growth is bi-directional: domestic conditions foster growth of export, but export also promotes domestic growth.

The trade theories further suggest that the causal linkages between exports and economic growth are sector-specific. Export base theory, as originally conceived, suggests that resource intensive sectors, such as food products, paper, and lumber, with strong, direct multiplier linkages to local economies are especially likely to exhibit export-led growth. Alternatively, endogenous growth theory suggests that high tech and R&D intensive products are most likely to foster export-led growth in second stage industries, such as heavy industrial products, which are affected by cost considerations. Geographic work on industry localization also stresses the importance of high technology sectors, suggesting that formation of high-tech industrial districts leads to growth of exports. Finally, new trade theory indicates that scale-intensive industries, such as chemicals or transportation equipment, are especially likely to be associated with bi-directional linkages between exports and state economies.

At the state or regional level, the linkages between exports and economic growth have been studied within two distinct bodies of literature. The first focuses on interregional exports (Richardson 1985, Nishiyama 1997, Mulligan and Fik 1994), while the second emphasizes international exports (Erickson 1989, Coughlin and

Cartwright 1987). Studies focused on the interregional exports of states, cities and local areas typically involve application of export-base theory to the question of whether a region's export sector drives non-export activity. Studies of state international exports, which are more pertinent to the present study, have considered the impacts of foreign exports on state or regional economic growth.

In a recent paper, Leichenko (1997) directly explores the issue of foreign export-growth linkages across different regions of the United States. The results of the study suggest a bi-directional Granger causal relationship between exports and production and a mixed Granger causal relationship between exports and employment. Despite limited evidence, the issue of causality between foreign exports and regional economic performance has been raised within the state international export literature. Erickson (1989, 1993) suggests that the foreign export performance of a state may depend largely on economic conditions in that state. Studies by Markusen et el. (1991), Erickson et el. (1995), and Moponen et el.(1997) using shift-share methods also raise questions about the importance of foreign versus domestic markets. These studies find that for many cities and regions, sales to domestic markets are a far more important source of economic growth than sales to foreign markets. Shift-share studies have also demonstrated variation across different regions and industrial sectors in the contribution that foreign exports make to regional economic change (Hayward 1995; Hayward and Erickson 1995).

3.1. Determinants of Employment Growth

The major factors that affect the state employment growth can be decomposed into (1) foreign demand, (2) domestic demand, and (3) incentive system. For the purpose of analysis, I analyze foreign and domestic contribution to state economic recovery; employment growth, an indicator for the economic growth, is explained through

export growth, domestic market potential growth, and beginning year's economic incentive level.

Export growth is represented by the annual export growth rate of the state. Because employment figures would increase as export increases, we expect a positive relationship between export and employment. If the economic recovery of the state were caused by foreign demand, the coefficient of this variable would be high compared to that of other periods.

The growth of domestic potential demand is represented by the annual growth rate of market potential. The ratio of state personal income to value-added of manufacturing is adopted to indicate the state's market potential. State personal income captures the expenditure capacity or the demand side, and value-added of manufacturing captures the supply available. If demand is higher than supply, there will be incentives for the state economy to expand or produce more, thus increasing the rate of employment growth. Annual average wage of the state is adopted as an incentive indicator for the labor market. If the average wage in the state is high, the state would lack merit in attracting new employment and firms may seek other places with lower wages to meet labor needs.

The basic methodology is cross-sectional regression analysis of 51 states. The dependent variable is employment growth between t_1 and t_2 as a measure of state economic growth. This model is to explain the degree of importance of the export and domestic growth in state economic growth after the 2001 recession. The model is estimated using ordinary least squares for the period of 2001-2004 where available data exist.

$$Gemp_{i,t_2-t_1} = f\{G\exp_{i,t_2-t_1}, (Gstperinc/VAMG)_{i,t_2-t_1}, (wage/emp)_{i,t_1}\} \quad (3\text{-}1)$$

where *i* represents observations across states, $Gemp_{t2\text{-}t1}$ is the growth rate of employment between t_1 and t_2, $Gexp_{t2\text{-}t1}$ is the growth rate of state exports between t_1 and t_2, $(Gstperinc/VAMG)_{t2\text{-}t1}$ is the growth rate of the ratio (state personal income over the value-added of manufacturing sector) between t_1 and t_2, and $(Wage/emp)_{t1}$ state average annual wage at t_1.

The results support the expectation that foreign demand and domestic demand potential lead to higher employment. The sign for both export and domestic demand is positive and significant at 99% and 95% respectively. The average state wage has negative sign in that higher employment growth occurred in times of lower wage. This negative sign implies that the state with low average wage would be relatively fast in creating employment, thus that the wage equalization would happen between 2001 and 2004. However, because the wage variable is not significant at the 90% level, caution is advised.

The coefficients of the results represent the elasticity because both dependent and independent variables are growth rate *minus wage/emp*. For the interpretation, annual growth rate model and proportional growth ratio model are performed respectively. In model 1, if export and *stperinc/VAMG* grows 1 % annually, then employment would increase 0.058% and 0.187% respectively. In model 2, the coefficients of export and *stperinc/VAMG* represent relative contribution to the employment growth. That is, if the export and stperinc/VAMG grows 1 % in a certain period, then employment would grow 0.058% and 0.062% respectively. The difference between model 1 and 2 is that in model 2 we can observe and compare the

relative contribution of foreign and domestic demand to employment because of compensation of the growth magnitude. Export's contribution to the state employment growth would be 0.058 compared to 0.062 of domestic demand potential; in determination of state employment growth, both foreign and domestic contributed to a similar extent between 2001 and 2004. The coefficient of wage is –0.021, in that $1,000 increase in state average annual wage would move 0.02 person to other states or diminish a job.

Table 3-1. Estimation Results for State Employment Growth

	Model 1 (annual growth rate)			Model 2 (proportional growth ratio)		
	Coeff.	t	P>|t|	Coeff.	t	P>|t|
Constant	0.005	0.71	0.480	-0.058	-2.11	0.040
Gexp	0.058	3.67	0.001	0.058	3.67	0.001
Gstperinc/VAMG	0.187	2.33	0.024	0.062	2.33	0.024
Wage/emp	-0.021	-1.15	0.258	-0.021	-1.15	0.258
R^2	0.288			0.288		
F	6.32			6.32		

The results of the regression explain employment growth well through foreign demand, domestic demand potential, and state incentive of the beginning year. State employment growth is driven almost equally by both foreign demand and domestic demand, and the states with lower wage benefit more in employment growth through recovering after the 2001 recession.

Naturally, an increase in the demand for the state's exports increases export production and shifts the demand curve to the right, creating more jobs. The fact that

export growth explains employment growth as having almost the same magnitude as the domestic demand potential means that the multiplier effects of export, considering jobs in manufacturing export goods, are far less than non-related jobs. Intuitively, exports relate not only to direct goods exported but also to indirect services and goods supporting; thus export would have multiplier effect to promote higher employment and speed recovery from the 2001 recession.

3.2. Export Growth Performance

The analysis of export growth in New York State uses the shift-share technique. This enables the assessment of a region's overall performance relative to other regions. Focusing on export growth, shift-share analysis is computed for all 21 sectors of manufacturing in New York State in order to compare the rates of growth and the regional competitiveness of the state in these industries.

The export growth of New York State is first decomposed into a share component (AS), which estimates how much growth would have occurred if each industry sector in the region grew at the average rate of all industries nationally. This captures the region's share of the nation's overall export growth. The shift component includes two effects: the industry mix effect (IM); and the competitive effect (CS). The industry mix effect represents what additional growth occurred because of the region's particular industry mix, measuring how much more the region should have grown because it contains a mix of industries that was growing relatively fast or slow nationally. The competitive effect estimates how regional industries grew relative to identical industries nationally. Thus, this measure represents the competitiveness of regional industries with industries nationally.

$$
\begin{aligned}
NRC_s &= E_s G_s - E_s G_n = \sum\nolimits_i (E_s S_{is} G_{is} - E_s S_{in} G_{in}) \\
IM_s &= \sum\nolimits_i E_s (S_{is} - S_{in}) G_{in} \\
CS_s &= \sum\nolimits_i E_s S_{in} (G_{is} - G_{in}) \\
AS_s &= \sum\nolimits_i E_s (S_{is} - S_{in})(G_{is} - G_{in})
\end{aligned}
\qquad (3\text{-}2)
$$

From the table, more than 80 % of total exports of New York State are from chemical (325), primary metal (331), machinery (333), computers and electronics (334), transportation (336), and miscellaneous manufactures (339). Among them, export of primary metal manufactures (331) notably decreased during 1999-2005, whereas the other sectors increased in the same period.

The share components show what the increase in export would have been in each region had it grown at the overall national rate of 28.5 %. The industry mix components give the adjustment to this share component that is due to New York State's unique industrial composition. The industry mix effects appear as the main source of regional competitiveness in export growth. In other words, New York State benefited from having an industrial mix made up of more industries that were growing fast relative to the industrial mix in the country as a whole. The competitive effects in New York State are less than for other states, especially in the chemical (325) and primary metal manufacture (331) sectors. However, export in 13 out of a total 21 manufacturing sectors proved to grow faster than export in those sectors nationally. Competitiveness in computer and electronic production (334) stands out among them.

Table 3-2. Shift-Share Analysis for Export Change Between 1999 and 2005

Industry	AS	IM	CS	Total
311. Foods	137,608	-28,461	137,311	246,458
312. Beverage & Tobacco	22,210	-50,486	17,581	-10,695
313. Fabric Mill	114,680	64,742	-347,260	-167,837
314. Textile	19,305	-9,035	37,862	48,131
315. Apparel	99,927	-240,861	203,198	62,264
316. Leather	37,104	-10,963	-6,685	19,456
321. Wood	60,081	-66,294	14,901	8,688
322. Paper	157,346	-40,826	-26,118	90,403
323. Printing	186,242	-61,606	-157,057	-32,422
324. Petroleum & Coal	16,618	98,587	153,800	269,005
325. Chemical	1,112,332	1,569,043	-1,957,038	724,337
326. Plastic & Rubber	155,331	13,260	85,437	254,028
327. Non-Metallic	100,305	-59,340	180,813	221,778
331. Primary Metal	1,231,168	1,339,962	-4,486,765	-1,915,634
332. Fabricated Metal	222,651	-22,822	7,241	207,070
333. Machinery	1,318,635	370,939	-257,520	1,432,054
334. Computer & Electronic	1,710,916	-1,397,030	911,450	1,225,337
335. Electrical Equip.	257,026	-3,309	-69,053	184,664
336. Transportation	1,102,085	-270,197	787,011	1,618,889
337. Furniture	22,365	-4,172	11,870	30,064
339. Miscellaneous	1,310,247	2,387,983	1,963,815	5,662,045
Total	9,394,184	3,579,115	-2,795,206	10,178,093

3.3. Trade-related Factors Explaining the Fluctuations of Employment

Given the result of the first model - that the contribution of foreign demand to state employment is as large as that of domestic demand, and is still increasing - this second model then analyzes which trade-related factors explain the fluctuations of employment in New York State. Here the model of supply and demand was adopted to estimate the impact of the relative exchange rate, the relative price on employment, using time series data from January of 1990.

On the demand side, an appreciation in the relative value of the US dollar increases the relative price of home to foreign goods, increasing $e=EP/P^*$ and employment. On the supply side, the output and employment of each sector depends on its price relative to the nominal product wage. As the real wage falls, supply and employment increase.

The exchange rate change will alter the value of the nominal variables relative to those abroad and thus bring about changes in output and employment. If the relative exchange rate rises - appreciation - then export will increase and thus employment will increase. On the contrary, if the relative exchange rate drops - depreciation - then export and employment will decrease and import increase. These changes in employment depend not only on export and import but also substitution between imported and home-made goods. Thus, the sign of the relative exchange rate coefficient would be different between sectors representing industry characteristic and regional economic structure. The relative price is represented by the consumer price index. This variable reflects the structural changes in demand, catching the effects of shifts of living cost on employment.

In order to capture the cyclical and secular changes in demand, time trend and national unemployment variables are also considered. Time trend reflects the secular changes of employment in each sector, and the national unemployment variable

reflects the cyclical changes, the fluctuations in aggregate demand. Therefore, the coefficient of the real exchange rate finds the distributive effects adjusted for cyclical and secular movements in total demand.

Seemingly unrelated regression method is used to compare the effects of each sector between January of 1990 and September of 2005. Employment within the manufacturing sector is disaggregated by the 21 industries defined by the NAICS system. Considering time lag of actual employment, dependent variables are 1 year lagged observations.

$$\log Emp_{i,t} = f(t, \log umemp_{t-12}, \log cpi_{t-12}, \log rer_{t-12}) \qquad (3\text{-}3)$$

where, i – industry sector according to NAICS

t – month from Jan,1990 to Sep, 2005

$Emp_{i,t}$ – the employment in sector i

$unemp_{t-12}$ – the national unemployment rate

cpi_{t-12} – the consumer price index of all urban consumers

rer_{t-12} – the relative exchange rate represented by nominal broad dollar index

3.4. Estimation Result

The analysis was performed with three sectors: agriculture, mining, and manufacturing. The manufacturing sector was particularly examined on a three digit level according to the North American Industry Classification System (NAICS). The coefficient of the variable time is negative in most sectors except the manufacturing sectors of food, computer and electronics, transportation, furniture and mining. The coefficient of manufacturing is –0.005, implying that employment will decline at the percentage rate

of –0.5% each month.

The cyclical variable *unemp* measures the impact of cyclical movements in the national economy. The predicted signs of this variable are all negative in every sector, as higher employment in each sector is associated with lower national unemployment rates. The relative price variable *cpi* is positive in *all* agriculture, mining, and manufacturing. However, examining all manufacturing sectors, 7 out of 21 have negative sign. The predicted sign of this variable is ambiguous. On the demand side, an increase in the relative price increased cost in all sectors, reducing employment. Seven sectors - food, beverage, printing, computer, electrical equipment, transportation, and furniture manufacturing - appeared to have negative signs. However, on the supply side, the increase in the relative price causes the product price to increase, and thus leads to more production and employment. In fact, 14 sectors have positive signs, meaning that these industries are more affected by supply capacity.

The sign of the real exchange rate variable *rer* is ambiguous, too. It catches the effects of other structural changes in the economy, including substitution effect between import and domestic goods. Agriculture and mining have negative signs, while the whole manufacturing sector has positive sign. 5 out of 21 manufacturing sectors such as food, beverage, leather, computer, and transportation equipment manufacturing have negative signs, meaning that if depreciation occurs, then employment would decrease because of decreased export and increased import.

The coefficients for the relative price (*cpi*), the real exchange rate (*rer*), and the unemployment rate variables (*unemp*) can be interpreted as elasticity. For example, a coefficient of 1.07 for the relative price variable *cpi* in manufacturing means that a 1 % increase in the relative price will lead to a 1.07 % increase in the number of workers employed. From the coefficients of the relative price variable *cpi* and the

real exchange rate variable *rer*, the structural characteristics of each industry in New York State can be found as follows: Firstly, the southeast quadrant is for leather (316). Secondly, the southwest quadrant is for food (311), beverage (312), computer (334) and transportation (336). Thirdly, the northwest quadrant is for printing (323), electrical (335), and furniture (337). Finally, the northeast quadrant is for the others.

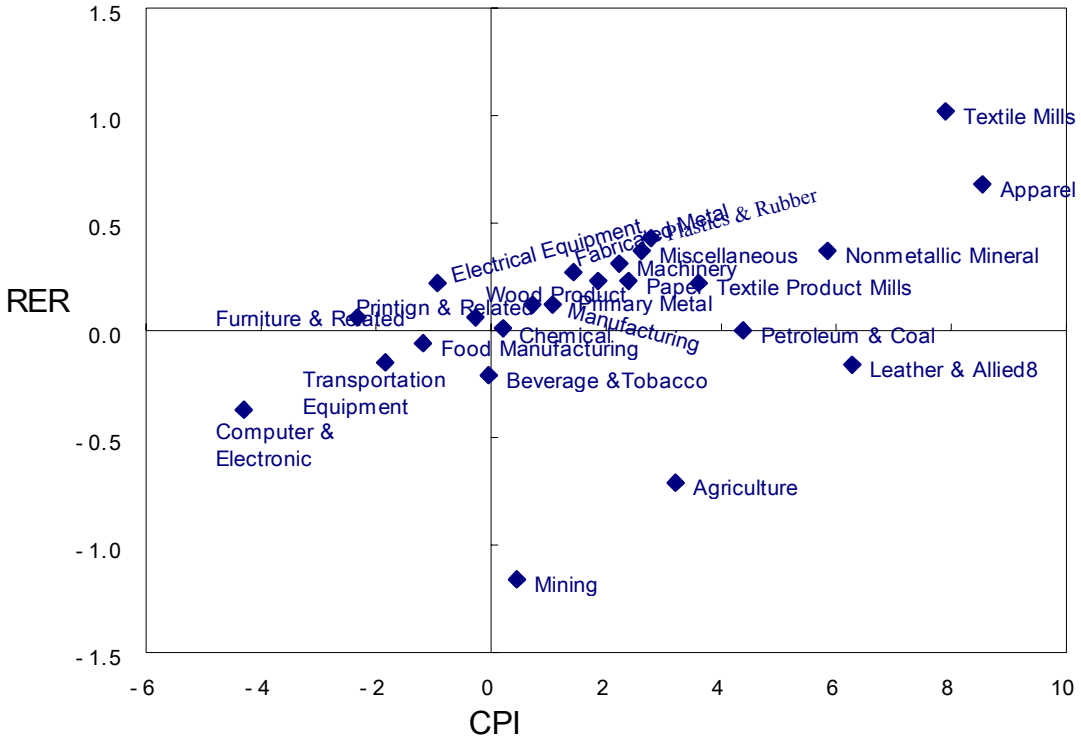


Figure 3-1. Trade-related Structure by Industries of the New York State

Table 3-3. Regression Results for Employment of New York State, 1990-2005

	R^2	*t*	*unemp*	*rer*	*epi*
11 Agriculture	0.326	-0.00	-0.48	-0.71	3.21
		(-0.93)	(-5.29)**	(-3.12)**	(2.26)*
21 Mining	0.228	0.00	-0.31	-1.16	0.45
		(1.22)	(-4.66)**	(-7.09)**	(0.44)
31·33 Manufacturing	0.979	-0.01	-0.17	0.12	1.07
		(-13.84)**	(-15.46)**	(4.47)**	(6.11)**
311 Food manufacturing	0.772	0.00	-0.05	-0.06	-1.18
		(4.91)**	(-4.16)**	(-2.1)*	(-6.36)**
312 Beverage and Tobacco	0.777	-0.00	-0.08	-0.21	-0.04
		(-1.02)	(-2.87)**	(-2.86)**	(-0.09)
313 Textile Mills	0.970	-0.03	-0.32	1.02	7.90
		(-23.34)**	(-9.79)**	(12.42)**	(15.35)**
314 Textile Product Mills	0.885	-0.01	-0.29	0.22	3.61
		(-19.38)**	(-11.6)**	(3.65)**	(9.35)**
315 Apparel	0.963	-0.03	-0.41	0.68	8.54
		(-19.38)**	(-9.92)**	(6.63)**	(13.22)**
316 Leather and Allied	0.989	-0.02	-0.16	-0.16	6.28
		(-21.08)**	(-5.13)**	(-2.05)*	(12.9)**
321 Wood Product	0.551	-0.00	-0.22	0.12	0.72
		(-3.05)**	(-10.13)**	(2.33)*	(2.17)*
322 paper	0.973	-0.01	-0.11	0.23	2.39
		(-16.3)**	(-6.82)**	(5.75)**	(9.37)**
323 Printing and Related	0.966	-0.00	-0.11	0.06	-0.27
		(-4.37)**	(-8.72)**	(1.96)*	(-1.43)
324 Petroleum and Coal	0.545	-0.01	-0.61	0.00	4.38
		(-3.94)**	(-6.59)**	(0.02)	(3.03)**
325 Chemical	0.980	-0.00	-0.07	0.01	0.21
		(-7.96)**	(-5.55)**	(0.27)	(1.14)
326 Plastics and Rubber	0.883	-0.01	-0.16	0.43	2.78
		(-13.48)**	(-7.94)**	(8.85)**	(9.07)**
327 Nonmetallic Mineral	0.703	-0.02	-0.22	0.37	5.85
		(-11.79)**	(-5.76)**	(3.88)**	(9.87)**
331 Primary Metal	0.916	-0.01	-0.25	0.23	1.86
		(-9.63)**	(-11.7)**	(4.35)**	(5.55)**
332 Fabricated Metal	0.843	-0.01	-0.25	0.27	1.43
		(-8.41)**	(-14.19)**	(6.17)**	(5.19)**
333 Machinery	0.967	-0.01	-0.22	0.31	2.23
		(-15.8)**	(-13.86)**	(7.82)**	(8.84)**
334 Computer and Electronic	0.865	0.01	-0.17	-0.37	-4.30
		(14.38)**	(-9.14)**	(-8.16)**	(-14.99)**
335 Electrical Equipment	0.973	-0.00	-0.17	0.22	-0.93
		(-3.77)**	(-10.14)**	(5.23)**	(-3.53)**
336Transportation Equipment	0.973	0.00	-0.03	-0.15	-1.84
		(1.77)	(-12.27)	(-3.55)**	(-6.88)**
337 Furniture and related	0.838	0.00	-0.23	0.06	-2.32
		(5.37)**	(-12.27)**	(1.32)	(-7.84)**
339 Miscellaneous	0.950	-0.01	-0.19	0.37	2.62
		(-16.17)**	(-11.49)**	(8.95)**	(10.11)**

t-values are in parenthesis.
*: significant at 95% level **:significant at 99% level

Chapter 4

Relationship between New York State and US Economic Fluctuations

Theories on economic fluctuations often view them as non-stationary processes, decomposing them into non-stationary parts and stationary parts. Decomposition of non-stationary processes can be done in various ways, but identification of such decomposition needs specific conditions and restrictions on variance and covariance. Following Cochrane (1991), this study uses decomposition into common trend and cyclical component. The hypothesis here is that the existence of a common trend indicates the presence of co-integrating processes. When a unit root test does not reject the existence of a unit root, it implies that the processes are co-integrated.

When VAR processes are co-integrated, the vector error correction model (VECM), which is basically re-parametrization of VAR, can be used for fitting VAR processes. The next sections describe the general specification of VAR and VECM, and provide model specification for the employment fluctuations in New York State.

4.1. Econometric Model: Johansen Vector Error Correction Model (VECM)

The vector error correction model (VECM) can be said to be a re-parameterization of the VAR for fitting VARs with the presence of co-integrating variables. The estimates of the corresponding VAR model can be retrieved from the estimates of the VECM model. For example, a VAR model with p lags can be rewritten in VECM as follows.

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \varepsilon_t \qquad (4\text{-}1)$$

$$\Delta y_t = v + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \qquad (4\text{-}2)$$

$$\text{where } \prod = \sum_{j=1}^{p} A_j - I_k \text{ , and } \Gamma_i = -\sum_{i=1}^{p-1} A_j .$$

If the variables co-integrate, a VAR of first differences is mis-specified, omitting the lagged variable, $\prod y_{t-1}$. In order to identify the parameters in this case, identification restrictions are required.

The Johansen restrictions are conventionally used for identification of co-integrating processes. In the Johansen VECM framework, deterministic can be identified from the mean of the co-integrating processes and the mean of the differenced series. Allowing for a constant and *a* linear trend, and assuming *r* cointegrating relations, the VECM can be rewritten as follows:

$$\Delta y_t = \alpha\beta y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + v + \delta t + \varepsilon_t \,. \tag{4-3}$$

Because the above equation uses the first differences, the constant implies a linear time trend, and the time trend δt implies a quadratic time trend. In many cases, a trend of higher order time than a constant or a linear time trend are ignored. The deterministic trend components in the above VECM can be rewritten as follows:

$$\begin{aligned} v &= \alpha\mu + \gamma \\ \delta t &= \alpha\rho t + \pi t \end{aligned} \tag{4-4}$$

Using this representation of deterministic trend, the VECM equation can be rewritten as follows.

$$\Delta y_t = \alpha(\beta y_{t-1} + \mu + \rho t) + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \gamma + \pi t + \varepsilon_t \tag{4-5}$$

Depending on the restriction on time trend parameters, [?] τ and ρ, the trend can be linear or quadratic, or no trend, and the trend can be stationary around zero or non-zero means.

The impulse response function for co-integrating VARs differs from the stationary VARs in the previous section, in the sense that an orthogonolized impulse response function of stationary VARs fades away toward zero while that of co-integrating VARs do not fade away. In other words, the impact of the shock in stationary VARs is just transitory, while the shock has permanent impact in non-stationary, co-integrating VARs.

When the shock has permanent impact, the cumulative impulse response function can diverge over time. However, the FEVDs give the same interpretation for both stationary VARs and co-integrating VARs. For co-integrating VARs, however, the interpretation from FEVDs is valid only for a finite number of steps, since the mean square error of the forecast is diverging.

In this paper, the VECM representation of VAR (4) can be written as follows:

$$\begin{aligned} \Delta E_{NY,i,t} &= \alpha + \varpi E_{US,t-1} + \tau E_{US,i,t-1} + \pi E_{NY,t-1} \\ &\quad + \vartheta E_{NY,i,t-1} + \sum_{m=1}^{s} \Pi_m E_{US,t-m} + \sum_{m=1}^{s} \Gamma_m E_{US,i,t-m} + \sum_{m=1}^{s} \Psi_m E_{NY,t-m} + \sum_{m=1}^{s} \Lambda_m E_{NY,i,t-m} + \mu_t \end{aligned} \tag{4-6}$$

This VECM representation can be rewritten with deterministic trends of co-integrating VARs as follows:

$$\Delta E_{NY,i,t} = \mathrm{A}E_{US,t-1} + \mathrm{B}E_{US,i,t-1} + \Phi E_{NY,t-1} + \Theta E_{NY,i,t-1} + \sum_{m=1}^{s} \Pi_m E_{US,t-m} + \sum_{m=1}^{s} \Gamma_m E_{US,i,t-m} + \sum_{m=1}^{s} \Psi_m E_{NY,t-m} + \sum_{m=1}^{s} \Lambda_m E_{NY,i,t-m} + v + t + \mu_t \quad (4\text{-}7)$$

The deterministic trend, that is, permanent impact of the shock, is represented by linear and quadratic time trend as explained above, while the parameters for lagged variables capture the temporary impact.

4.2. Decomposition of Common Trend and Cyclical Components

Table 4-1 shows the augmented Dickey-Fuller test for US employment and New York State employment. The existence of a unit root cannot be rejected for log of US and log of NYS employment. However, it is rejected for the residual of the regression of log NYS on log of US. Thus, New York State and US employment are co-integrated, and stationarity is achieved by first differencing. The levels of the series appear to be I(1), while first differences are I(0).

Table 4-1 . Unit Root Test for Co-integration

Dependent variable	Independent variables	Unit root (p value)
ΔUS_t	1, ΔUS_t,……ΔUS_{t-3}, US_{t-1}	0.1307
ΔNY_t	1, ΔNY_t,……ΔNY_{t-3}, NY_{t-1}	0.6639
$\Delta S_t = \Delta(NY_t - US_t)$	1, ΔS_t, ……ΔS_{t-3}, S_{t-1}	0.0508

Now, for the question on the presence of common trend, the VAR and VECM are estimated. Table 4-2 shows permanent and temporary decomposition of total employment. The VAR model estimates sho*s* that when the total employment of the US is fixed, any change in the total employment of New York State affects both US and New York State employment only through temporary components. Therefore, the total employment of New York State will only have a transitory effect. Figure 4-1 below shows the common trend (permanent) component and cycle (transitory) component.

Table 4-2. Permanent and Temporary Decomposition

	Const.	NY(1) - US(1)	ΔNY (1)	ΔNY (2)	ΔNY (3)	ΔUS (1)	ΔUS (2)	ΔUS (3)	R^2
1. Vector autoregression									
	-0.044	-0.016	-0.203	-0.101	0.269	0.240	0.600	0.073	
ΔNY	(0.010)	(0.004)	(0.079)	(0.079)	(0.077)	(0.160)	(0.159)	(0.158)	0.436
	0.003	0.001	0.046	0.012	0.076	0.250	0.308	0.163	
ΔUS	(0.005)	(0.002)	(0.040)	(0.039)	(0.039)	(0.080)	(0.079)	(0.079)	0.598
2. P-T decomposition									
r′□ =(0,1); a′=(1,1)									

The next Table 4-3 . shows the decomposition of common trend and cyclical component using VECM. The likelihood-based Johansen co-integration test is also used to test for co-integration in the vector error correction model (VECM). The test

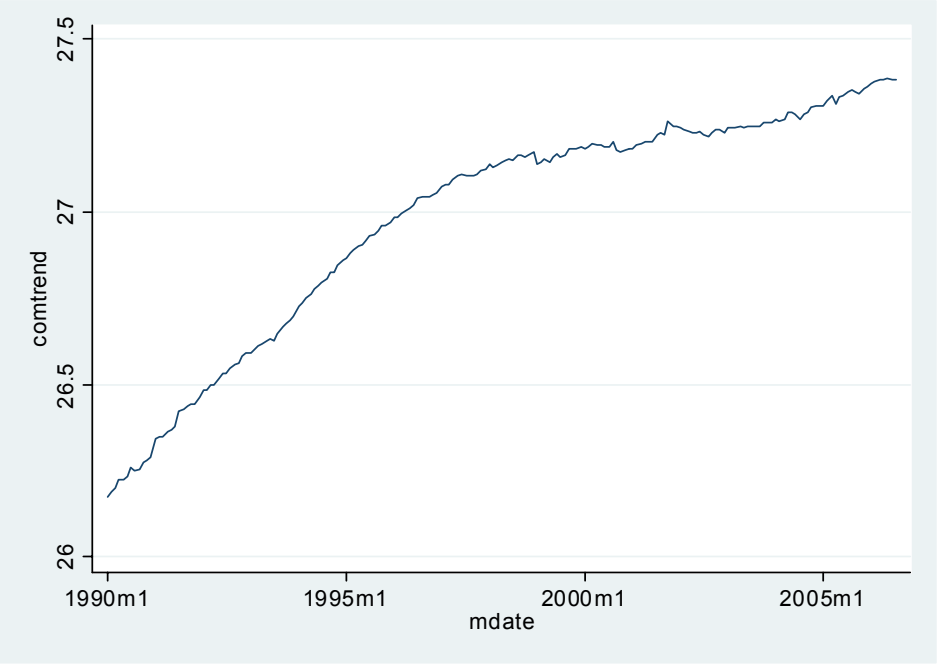
statistics indicate a single co-intergrating relationship between US and NYS employment. The employment series appears to have common trends, that is, one common permanent component between US and New York state.

Overall, the results indicate that the model fits quite well. The coefficient on US total employment in the co-integrating equation is statistically significant, as is the adjustment parameter, α in the NY equation. Although the adjustment parameter of α in the US equation is not significant, all the adjustment parameters have the correct signs and imply rapid adjustment toward equilibrium in terms of NY employment.

The estimate of the coefficient on NY employment is -0.976. Thus when the average NY total employment is too high, it quickly falls back toward the national level. The estimated coefficient on US employment is 0.051, implying that when the average US total employment is too high, the average NY total employment quickly adjusts toward the US figure, which in turn adjusts somewhat slowly toward NY level at the same time.

From the estimates from the co-integrating equation, 1 of NY and -1.128 of US, NY total employment is below its equilibrium level. In Table 4-2, 4 lag terms are included and the Johansen identification scheme has placed constraint on the parameters in beta, NY=1, US=0, the result (significant coefficient of -1.203031 is not zero) indicating the existence of an equilibrium relationship between NY employment and US employment.

Common trend



Cyclical component (NYS)

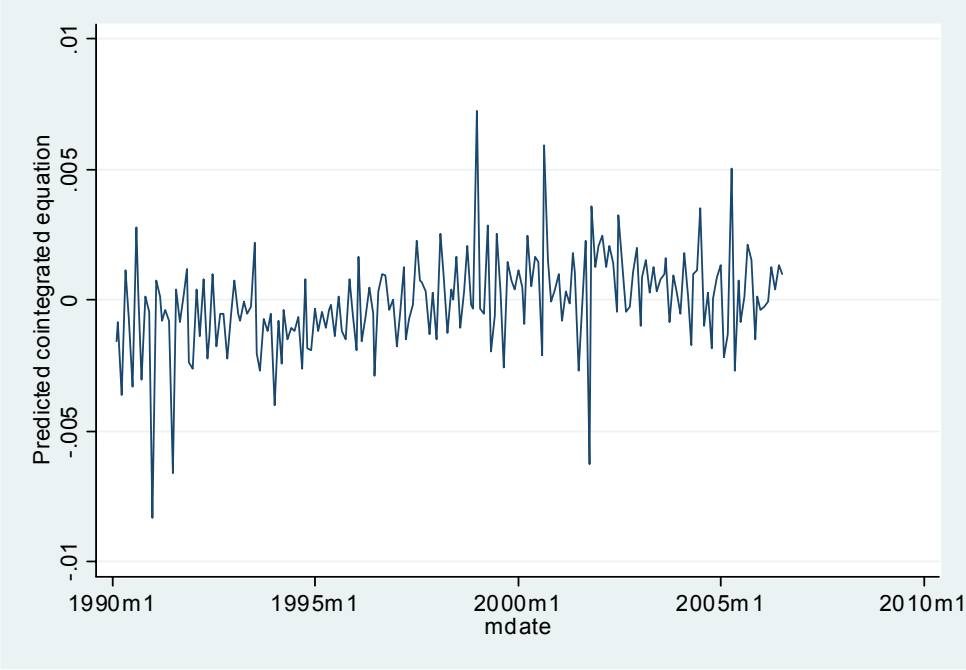


Figure 4-1. Common Trend and Cycle

Table 4-3. VECM estimation

	Const.	alpha	ΔNY lags	ΔUS lags	R^2
1. Vector Autocorrection Model					
ΔNY	-0.000	-0976	-0.017	0.827	0.505
	(0.000)	(0.121)	(0.083)	(0.157)	
ΔUS	-0.000	0.051	0.012	-0.526	0.27
	(0.000)	(0.055)	(0.038)	(0.072)	
2. Cointegrating equations					
	Const.	ΔNY	ΔUS		
	0.001	1	-1.128		
	.	.	(0.098)		

4.3 Cyclical and Structural Adjustments of the New York State Economy

While New York State in general follows national trends, the depth and duration of recession and subsequent recovery in New York State would be quite different. Cyclical adjustments are reversible responses to the employment required for a firm's products, while structural adjustments transform a firm, or an industry, by relocating workers and capital. The job losses associated with cyclical shocks are temporary. At the end of recession, industries rebound and laid-off workers are recalled to the firms or find comparable employment in other firms. By contrast, structural job losses are permanent. They can only be offset by new jobs in other firms.

Structural employment changes can be traced to changes in the shifts in trade flows, consumption patterns, and advances in technology. The growth of trade

intensifies competition across regions, compelling many manufacturers to trim their workforce. The demographic trend toward an older society has led to an increase in the consumption of personal, travel, health, and entertainment services. The use of new technologies in the production process has enabled firms to increase productivity and permanently reduce their labor needs. As a whole, all these factors have contributed to a decline in manufacturing jobs and a rise in service jobs; that is, fundamental structural shifts are taking place in both New York State and the nation.

In order to examine the influence of structural employment changes before and after recession in New York State, two recession periods - from July of 1990 to March of 1991 and March of 2001 to November of 2001 - are adopted, according to NBER classification.[5] Following Groshen and Potter (2003), I isolate those industries that experienced structural job gains and losses from those that underwent cyclical job adjustments by comparing the growth in employment experienced by each industry during the recession with the growth experienced by that same industry during the recovery period after the trough.

Technically, an industry is identified as one that is declining structurally, and job losses are permanent if the industry loses jobs during both the recession and recovery. Similarly, I identify an industry that gains jobs in both periods as one that is growing structurally. By contrast, an industry would be identified as a cyclical industry if the industry loses jobs during the recession but regains them during the

[5] From July 1990 to March 1991 and from March 2001 to November, employment declined 1.1 % and 1.2 % in the nation and 2.9 % and 2.3 % in New York State respectively.

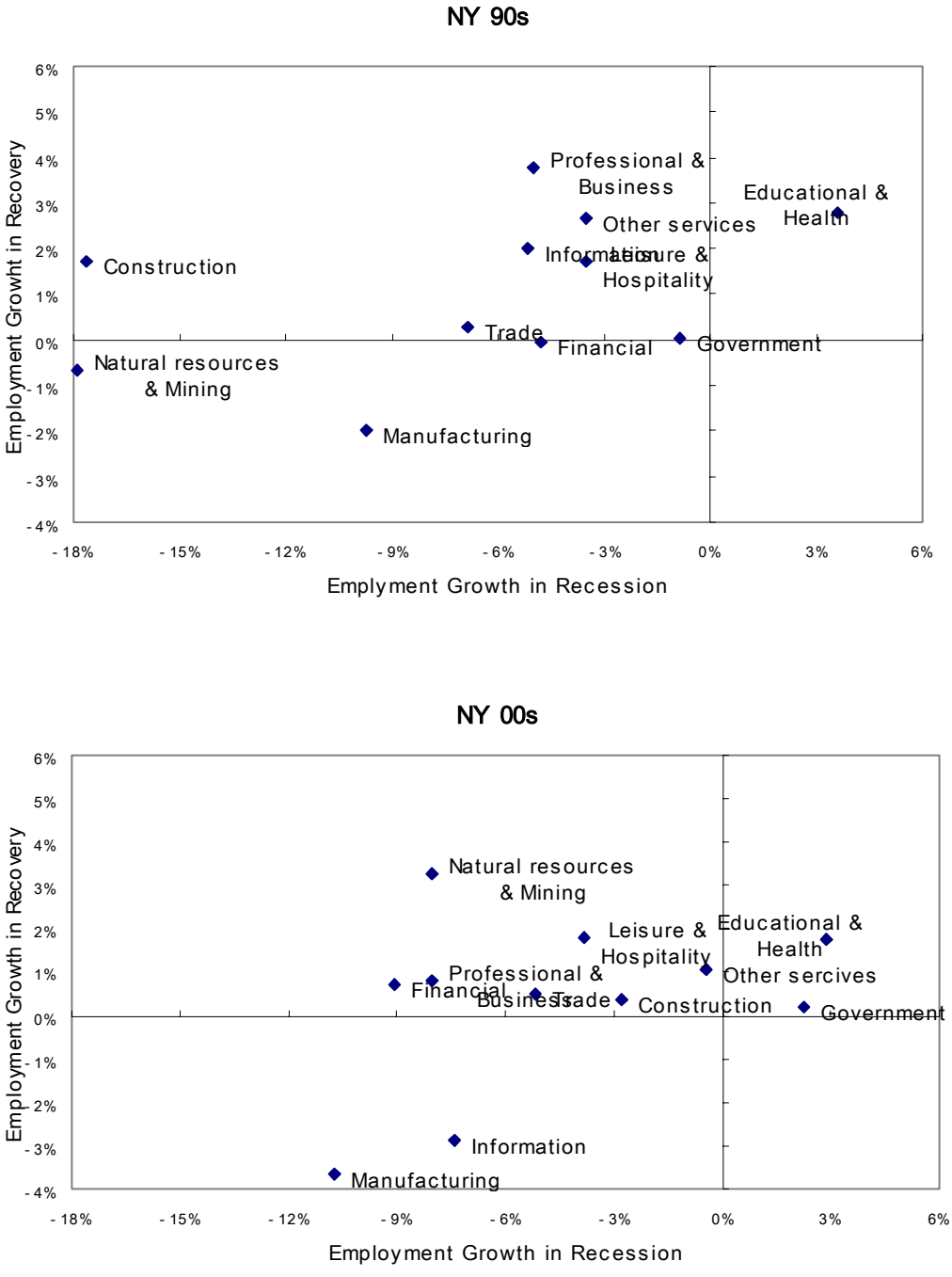
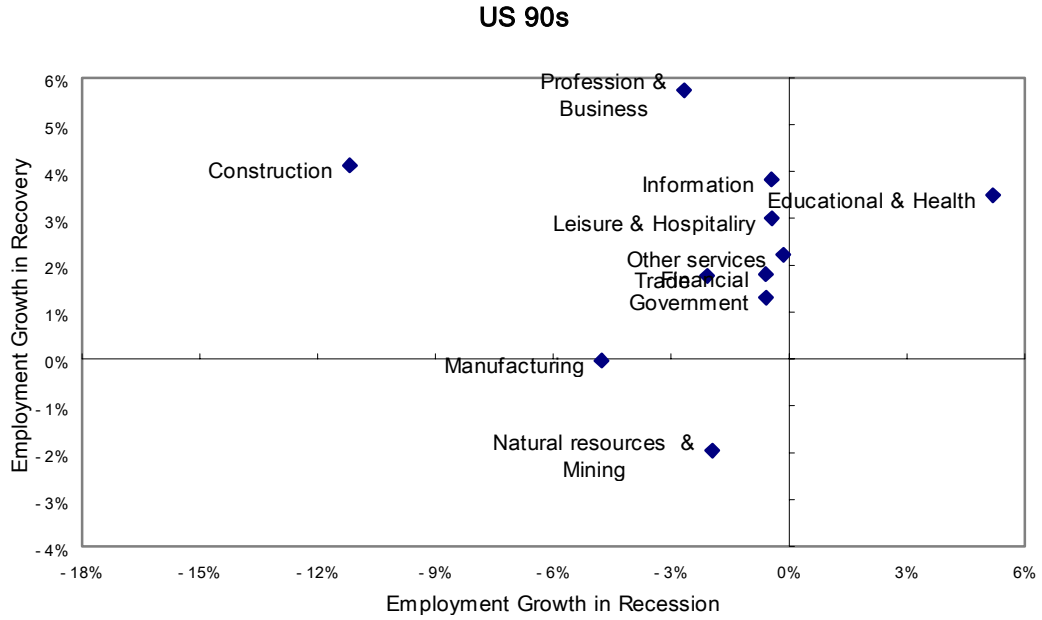


Figure 4-2. Job Adjustments by Industries During the Recession and Recovery of the NYS Economy



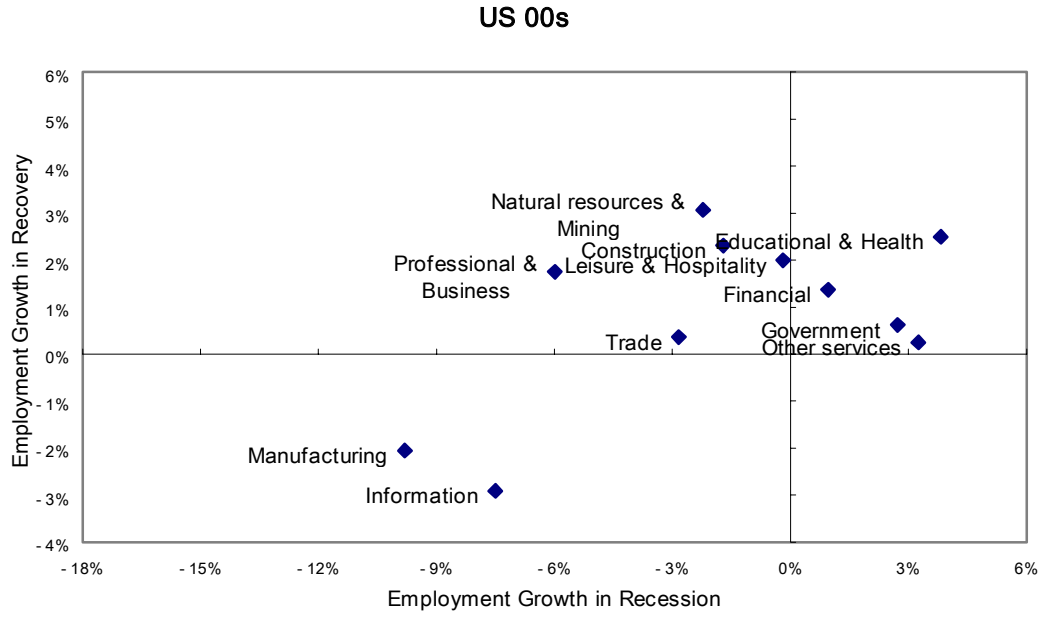


Figure 4-3. Job Adjustments by Industries During the Recession and Recovery of the US Economy

recovery. Industries that expand their payrolls during the recession and cut them during the recovery are deemed to be experiencing counter-cyclical change.

Chapter 5

Sectoral Fluctuations in New York State Employment Growth

Examining regional employment variation to know which sectors are responsible for growth is indispensable in the regional policy context. Many regional analyses are based on the differences of the industries across regions. In analyzing the decline of the New York State economy, sectoral fluctuations are also a major part of the analysis, since New York employment growth was caused in great measure by the decline in the manufacturing industry.

Previous literature analyzed the regional employment growth in various aspects. Some view fluctuations of employment growth as fluctuations in the business cycle context, decomposing the employment fluctuations across U.S. regions into a common component as well as considerable heterogeneity among regions. This strand of literature on regional employment fluctuations suggests that shocks tend to have a permanent impact on regional employment growth rate. Blanchard et al (1992) examined how the states adjusted after adverse employment shock by looking at relative wages, unemployment rate and employment rate, and analyzing the regional booms and slumps over 40 years in the U.S. Their findings were that employment shocks have permanent effects on state growth rate, contrary to the expectation that they would return to the same growth rate at the interstate level, resulting in a permanently different employment pattern. Relative wage and unemployment rate or shocks on wages and unemployment rate, on the other hand, are found to be temporary and steady. Adverse employment shock initially increases unemployment and reduces participation, but the effect disappears after about five to seven years. Nominal wages decrease by adverse employment shock, triggering some recovery in employment, but they return to normal after about ten years. Blanchard et el. conclude

that differences in the persistent state growth rate result from the movements of the firm that triggered movements of workers.

Other studies examine the sectoral model as the source of regional economic fluctuations. Literature on sectoral sources has various focuses, such as the interplay between regional sectors and metropolitan sectors, and the role of aggregate shock versus sectoral shock. At the metropolitan level, the similar phenomenon can be seen in suburbanization. Central cities have lost shares of employment and population, whereas suburbs have gained in share of employment and population as metropolitan economies have grown. The relationship between central city and suburb has traditionally been one of substitution, in that suburban growth is at the expense of potential growth of downtown. Recent studies, however, have found evidence that the relationship between central city and suburb could be complementary. Chang et el (2001) document that the extent to which such complementary relationship can be found depends on the particular sector and time duration of the shocks. In the short run, local shocks were influential in both central city and suburb, but the long run saw cross effects across the central city and suburb.

Carlino and Defina (1995) also examine sectoral shocks at the metropolitan level, analyzing the relative importance of such sectoral shocks compared to aggregate shocks. They find that sectoral shocks account for most of the employment fluctuations, while aggregate shocks play a less important role.

In fact, regional employment variation is naturally a reflection of the sum of employment growth or decline in various industries in the region. Some sectors move in the same direction, while the others do not. Some sectors grow faster than the average regional growth. Also, sectoral growth is oftentimes correlated with the aggregate growth. These factors make modeling of sectoral fluctuations complicated, and a method for isolating the separate contributions of the various regional industries

over time is imperative. In modeling the interaction between the aggregate fluctuations and the sectoral fluctuations, Chang and Coulson (2001) adressed that the model needs to be sectoral to examine sector-specific impacts, to be dynamic to capture the "spread and backwash" effects (Krakover,1983), and to be able to identify the exogenous sources of fluctuations. Most of the literature, thus, often uses vector auto-regression (VAR) with sectoral models in order to allow interaction between each sector and the aggregates. VAR, which can be viewed as the reduced form of dynamic simultaneous equations, is a convenient tool for isolating sectoral contributions. It provides a mechanism for constructing innovations in various sectors that are orthogonal to each other, and allows the implementation of a technology for assessing the dynamic impact of these separate shocks. This method is related to shift-share analysis in that it precludes cross-industry effects except through their impact on aggregate totals. [6]

In examining the sectoral sources of employment fluctuation in New York State, the main inquiries of this paper are the contribution of each sector on regional employment, the role of regional export, and the possible interaction between each sector. One of the difficulties in identifying the sectoral sources arises from possible interplay between different industrial sectors. This paper firstly assumes that there is no interaction between industrial sectors, and then analyzes alternative models with industry interaction. For the sectoral model without industry interaction, this study uses a VAR model, assuming the hierarchical nature of the variables. With US aggregate shock as the baseline, it analyzes whether orthogonal US industrial and New York State aggregate shocks also affect fluctuations in employment growth of New York State industry. Accordingly, it is assumed that US variables have a

[6] As seen in shift-share analysis, economic performance of a region is believed to be different from the national economic performance only to the extent that industry mixes vary in the region.

contemporaneous causal influence on state variables, but not the reverse; and that aggregate variables have a contemporaneous causal influence on industry variables, but not the reverse.

In addition, in order to see the contribution of foreign export to New York State, such export is added to above model. We need to identify the causal relation between export and sectoral employment, in addition to the principle of shift-share. Thus, hierarchy is given on top of US factor to local factor, and on top of aggregate factor to sectoral factor. The relation between export and sectoral factor is assumed to be two-way.

5.1. Econometric Model: Vector Autoregression Model (VAR)

Generally speaking, a vector autoregression (VAR) can be written as a model in which *K* variables are specified as linear functions of *p* of their own lags, *p* lags of the other *K-1* variables, and additional exogenous variables.

$$y_t = \alpha + A_1 y_{t-1} + \cdots + A_p y_{t-p} + Bx_t + u_t \tag{5-1}$$

where $y_t = (y_{1t}, \cdots, y_{Kt})'$ is a $K \times 1$ random vector, A_p is $K \times K$ matrices of parameters, x_t is an $M \times 1$ vector of exogenous variables, u_t is an error term that is not serially correlated. When no a priori assumptions on the error variance covariance matrix, Σ, are imposed, it is hard to interpret the causal relationship from fitting VAR. When the VAR is covariance stationary, that is, the first two moments, mean and variance, are independent of time, it has infinite order vector moving average representation. In a simple example of no exogenous variables, if VAR is stable, the above random vector, $y_t = (y_{1t}, \cdots, y_{Kt})'$, can be rewritten as follows.

$$y_t = \mu + \sum_{i=0}^{\infty} \psi_i u_t \tag{5-2}$$

where μ is the $K \times 1$ time invariant mean, and ψ_i are $K \times K$ matrices of moving average coefficients. The coefficient of the moving average representation, ψ_i, are the impulse response functions at horizon *i*. The *j, k* element of ψ_i provides the impact of a time increases in the *k*th element of u_{it} on the *j*th element of y_t after *i* period, status quo. However, this does not offer causal interpretation of the impact, since contemporaneous correlation between u_t suggests that a shock to one variable may be accompanied by shocks to other variables. Using mutually uncorrelated innovations that are orthogonal to u_t, this shortcoming can be overcome.

In other words, with a matrix P, which is $\sum = PP'$, then $P^{-1} \sum P'^{-1} = I_k$. The matrix P^{-1} is orthogonal to the error term, u_t, and the equation (2) can be rewritten as follows.

$$\begin{aligned} y_t &= \mu + \sum_{i=0}^{\infty} \psi_i P P^{-1} u_t \\ &= \mu + \sum_{i=0}^{\infty} \varpi_i P^{-1} u_t \end{aligned} \tag{5-3}$$

The choice of P matrix is similar to placing restrictions on dynamic simultaneous equations. Thus, identification of causal relationship is possible by using impulse response function with orthogonal P matrix, or putting restrictions using structural vector autoregressions (SVAR). The SVAR, thus, identifies the causal impulse response functions in model specification and estimation. The estimates of

variance covariance matrix, Σ, are obtained using maximum likelihood estimation based on the expected variance covariance matrix, $\hat{\Sigma}$, from underlying VAR.

Another way to examine the impact of shocks of one variable on another is the forecast error variance decomposition (FEVD). The FEVD is measured with a choice of P matrix and can be written in terms of the orthogonalized errors and error variances. Depending on the choice of a P matrix, different FEVD can be obtained. The FEVD examines the fraction of forecasting errors for variable *j* with orthogonalized shocks in variable *k*. In other words, it measures how many portions each shocks contribute to the total forecasting error variances.

5.2. Data Description and Model Specification

This study uses the monthly CES (Current Employment Statistics) series of the Bureau of Labor Statistics from January of 1990 through July of 2006 at the sectoral level. According to the industry classification based on NAICS of 2002, 11 sectors reclassified in the CES were used[7]: natural resources and mining (Mining), construction, manufacturing, trade and transportation and utilities (Trade), information services, financial services, professional and business services (profession), educational and health care services (education), leisure and hospitality services (leisure), other services, and government.

All data were log-transformed so that the estimated parameters can be interpreted as elasticity. Considering the original time series data as non-stationary, all the data were first differenced. The underlying assumption is that the data used in analysis are first difference stationary with no co-integration relationship among them.

[7] The highest level of NAICS classification is called the sector, and there are 20 broad sectors in NAICS, compared to only 10 divisions in SIC. The NAICS provides great detail in services with new sectors such as Information. Among 20 sectors, 11 sectors were reclassified in the CES except agriculture sector.

The treatment of seasonal fluctuations was not considered since the CES data already seasonally adjusted according to the x-12 ARIMA scheme of the Census Bureau of Statistics.

There are many statistics for the selection of lag-order in fitting the VAR model to the correct order. Results of pre-estimation lag-order criteria of likelihood ratio, FPE, AIC, HQIC, and SBIC indicate several lags for each sector, such as 1 month, 3 month, 6 month, and 12 months. However, because setting a different lag for each sector makes it difficult to compare the results, 3 month and 12 month, which are most frequent in FPE and AIC criteria, were adopted as an optimum lag period. In addition, I take a look at the data separately between 1996 and 2000, and between 2001 and 2006, when the economy suffers recession.

5.2.1. Baseline Sectoral Model

The first model assumes no interplay between industry sectors, which is similar to the sectoral model in Coulson (2001). Employment in the industrial sector is assumed to be affected by distributed lags of national employment, national employment in the same industrial sector, total New York State employment, and the employment of own industry. The set of equations are estimated using VAR as a more general framework of shift-share analysis, giving a hierarchy on top of nation factor to local factor, and isolating national growth, the sectoral growth within the nation, regional growth, and sectoral growth of the region. The fluctuations in New York sectoral employment are analyzed using VAR framework as follows:

$$E_{NY,i,t} = \alpha + \sum_{m=1}^{s} \delta_{t-m} E_{US,t-m} + \sum_{m=1}^{s} \gamma_{t-m} E_{US,i,t-m} + \sum_{m=1}^{s} \lambda_{t-m} E_{NY,t-m} + \sum_{m=1}^{s} \eta_{t-m} E_{NY,i,t-m} + \mu_t \quad (5\text{-}4)$$

where $E_{us,i}$ is the aggregate US employment, E_{us} is the US employment of the i the sector, $E_{ny,i}$ is the aggregate NYS employment, and $E_{ny,i}$ is the NYS employment of the i th sector. It is equivalent to the system of simultaneous equations as follows:

$$\begin{bmatrix} n_t \\ ni_t \\ s_t \\ si_t \end{bmatrix} = \pi \begin{bmatrix} n_{t-1} \\ ni_{t-1} \\ s_{t-1} \\ si_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix} \qquad (5\text{-}5)$$

where n_t is US aggregate employment at time t; ni_t is US industry employment at time t; s_t is New York state aggregate employment at time t; si_t is New York state industry employment at time t; π is 4×4 matrix of lag polynomials, that is, the estimated coefficients in the VAR; and ε is the residuals that represent the exogenous shocks to industry employment. The residuals can be decomposed into four orthogonal shocks associated with each variable,

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ w_{21} & 1 & 0 & 0 \\ w_{31} & w_{32} & 1 & 0 \\ w_{41} & w_{42} & w_{43} & 1 \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \\ \gamma \\ \delta \end{bmatrix} \qquad (5\text{-}6)$$

where α is the US aggregate shock, β is the US industrial shock, γ is the New York state aggregate shock, and δ is the New York state industrial shock, that is, the

idiosyncratic shock.

Here, the hierarchical nature of the variables was assumed. When US aggregate shock takes a role as the baseline, we can analyze whether orthogonal US industrial and New York State aggregate shocks also affect the variation in employment growth of New York industry. Accordingly, US variables have a contemporaneous causal influence on state variables, but not the reverse. Also, aggregate variables have a contemporaneous causal influence on industry variables, but not the reverse.

5.2.2. Export effect

There is a possibility that foreign export to New York State contributes to employment fluctuations in the state. In order to see the contribution of foreign export, New York foreign export is included in the above model. The second model additionally uses the total export of New York State from January of 1996 to July of 2006 as an exogenous variable in order to examine the effect of export on each sector. The export data are based on the origin of movement from which the merchandise starts its journey to the port of export, that is, the transportation origin of exports. The source of the data is from Foreign Trade Statistics of US Census Bureau. Due to restriction on available data, the analysis period is accordingly different from the first model.

Now, the concern is to identify the causal relation between export and sectoral employment, in addition to the principle of shift-share. To identify causal relation, hierarchy is given on top of US factor to local factor, and on top of aggregate factor to sectoral factor. The relation between export and sectoral factor is assumed to be two-way as follows,

$$E_{NY,i,t} = \alpha + \sum_{m=1}^{s} \delta_{t-m} E_{US,t-m} + \sum_{m=1}^{s} \gamma_{t-m} E_{US,i,t-m} + \sum_{m=1}^{s} \lambda_{t-m} E_{NY,t-m} + \sum_{m=1}^{s} \eta_{t-m} E_{NY,i,t-m} + \sum_{m=1}^{s} \psi_{t-m} Exp_{t-m} \quad (5\text{-}7)$$

$$\begin{bmatrix} E_{US} \\ E_{US,i} \\ E_{NY} \\ E_{NY,i} \\ Exp \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ \delta & \gamma & \lambda & \eta & \psi \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} E_{US} \\ E_{US,i} \\ E_{NY} \\ E_{NY,i} \\ Exp \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ w_{21} & 1 & 0 & 0 & 0 \\ w_{31} & 0 & 1 & 0 & w_{35} \\ w_{41} & w_{42} & w_{43} & 1 & w_{45} \\ w_{51} & w_{52} & w_{53} & w_{54} & 1 \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \\ \gamma \\ \delta \\ \theta \end{bmatrix} \quad (5\text{-}8)$$

where α is the US aggregate shock; β is the US industrial shock; γ is the New York State aggregate shock: δ is the New York State industrial shock, that is, the idiosyncratic shock; and ψ is the export shock. The contributions of various sources to the variance in employment growth at the national, industry, and state level are obtained using FEVD.

5.2.3. Cross-industry Effect

The third model considers the interplay between each industrial sector. It allows that industrial employment is affected by employment shock from each of other industries. The estimation was carried out using VAR model with industry interaction and SVAR model with various restrictions. Using SVAR model that imposes restrictions on the structural cross-equation variances, interplay between each industry can be modeled as just-identified equations. For cross-industry linkage, the simplest assumption would be that each sector is affected by other industries with an identical magnitude. Under this assumption, the SVAR with just-identified equations may be similar to the

VAR model with cross industry effect. For VAR model with cross industry effect, the econometric model can be written as follows.

$$E_{NY,i,t} = \alpha + \sum_{m=1}^{s} \delta_{t-m} E_{US,t-m} + \sum_{m=1}^{s} \gamma_{t-m} E_{US,i,t-m} + \sum_{m=1}^{s} \lambda_{t-m} E_{NY,t-m} + \sum_{i=1}^{j} \sum_{m=1}^{s} \eta_{t-m} E_{NY,i,t-m} + \mu_t \quad (5-9)$$

where $E_{us,i}$ is the aggregate US employment, E_{us} is the US employment of the i the sector, $E_{ny,i}$ is the aggregate NYS employment, and $E_{ny,i}$ is the NYS employment of the i th sector.

Another way of modeling cross-industry effect is to consider available input-output coefficient for each industry sector when estimating SVAR model. The input-out coefficient matrix is presented in Table 5-1. Rather than unrealistic identical cross-industry linkage, Carlino and Defina (2001) utilize an input-output matrix for cross-industry linkages. To get just identified estimation, they assign zero coefficients for lesser values of the two coefficients between two sectors. For example, as for mining and construction industries, two coefficients are available: 0.0077 for mining to construction and 0.0026 for construction in the mining sector. In this case, only larger values are considered, and 0.0026 for construction in mining is assumed to be zero. That is, it is assumed that construction has no contemporaneous effect on mining, while mining affects construction.

Table 5-1. Input-Output Coefficient Matrix

	Mine	Cons	Manf	Trad	.Inf	.Fin	Prof	Educ	Leis	Oth	Gov
Mine	0.1874	0.0077	0.1053	0.0751	0.0000	0.0006	0.0027	0.0003	0.0116	0.0005	0.0071
Cons	0.0026	0.0010	0.0018	0.0043	0.0027	0.0097	0.0047	0.0064	0.0097	0.0065	0.0211
Manf	0.1422	0.2603	0.3239	0.0556	0.0657	0.0147	0.0420	0.0835	0.1420	0.1651	0.0991
Trad	0.0641	0.1046	0.1026	0.0807	0.0266	0.0290	0.0308	0.0330	0.0639	0.0612	0.0494
Inf	0.0027	0.0089	0.0078	0.0112	0.2022	0.0099	0.0368	0.0241	0.0228	0.0261	0.0278
Fin	0.0588	0.0311	0.0244	0.0488	0.0663	0.1893	0.0694	0.0999	0.1026	0.0867	0.0349
Prof	0.0404	0.0750	0.0743	0.0812	0.1189	0.0770	0.1498	0.0932	0.0679	0.0861	0.1032
Educ	0.0002	0.0001	0.0008	0.0008	0.0028	0.0004	0.0013	0.0091	0.0008	0.0014	0.0151
Leis	0.0018	0.0020	0.0041	0.0053	0.0146	0.0067	0.0151	0.0151	0.0266	0.0090	0.0102
Oth	0.0056	0.0097	0.0098	0.0065	0.0149	0.0080	0.0118	0.0073	0.0111	0.0132	0.0143
Gov	0.0002	0.0011	0.0006	0.0024	0.0040	0.0024	0.0060	0.0095	0.0044	0.0066	0.0039

* Mine: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government

5.3. Estimation Results

5.3.1. Granger Causality Test for New York State Employment

Table 5-2 to Table 5-5 reports the Granger causality Wald test, e.g. whether the independent variables (US aggregate, US sectoral, and the NY State aggregate)

granger-cause the dependent variable (NY State sector)[8]. Table 5-2 includes New York State export from 1996.1 to 2006.7, and Table 5-3 to Table 5-4 separates the time periods for the time of economic growth and recession, beginning with January of 2001.

F-statistics in Table 5-2 indicate that Granger-causality varies dramatically across sectors of the New York State economy. For instance, while for some sectors, such as construction and manufacturing, only US sectoral shock appears to granger-cause NY State sectoral growth (US aggregate shock and NY state aggregate shock don't granger-cause NY sectoral growth), for other sectors - such as mining, trade, leisure, other services, and government - only NY State aggregate shock appears to granger-cause NY sectoral growth (US aggregate shock and US sectoral shock don't granger-cause NY sectoral growth). In other words, trade, leisure, other services, and government sectors seem to be more localized in New York State. As a whole, NY State aggregate shocks granger-cause 9 sectors out of 11, and US sectoral shocks affect 6 sectors out of 11. All three variables jointly granger-cause NY sectoral growth in 10 out of 11 sectors except mining.

Table 5-3 presents the results of Granger-causality with state export. Still, leisure, hospitality and other service sectors seem to be localized even if the state export data are included, because only the lags of the NYS aggregate granger-cause them. However, several changes appear. First and surprisingly, the lags in state export seem not to granger-cause employment in the manufacturing sector. Rather, NYS export appears to granger-cause construction, trade, and finance sectors. Second, information, professional and business service sectors appear to be affected

[8] A method for testing Granger causality is to regress *y* on its own lagged values and on lagged values of *x* and tests the null hypothesis that the estimated coefficients on the lagged values of *x* are jointly zero. Failure to reject the null hypothesis is equivalent to failing to reject the hypothesis that x does not granger-cause *x*.

mainly by US sectoral growth. Lastly, mining and natural resource sectors don't seem to be explained by any variables.

Table 5-4 explains New York State employment change for the period before the economic recession. While the overall tendency for each sector's causality before the recession is similar to that of whole period, the explanation of Granger causality in this short period is generally weak. One possible reason for this weakness is that monthly export data are original statistics that were not seasonally adjusted. Another reason might be the relatively short time period considered. Employment in manufacturing, finance, and education and health sectors is not jointly granger-caused from the total and sectoral employment of US and NYS plus NYS export. Meanwhile, construction, professional and business services, and government sectors are well jointly granger-caused from the dependent variables. Also for the construction, professional and business services, and government sectors, NYS export seems to granger-cause employment growth. Leisure, hospitality and other service sectors still appear to be localized.

Table 5-5 explains the results for the period just after the recession of 2001. During this period only mining, trade and transportation sectors are not jointly granger-caused from the dependent variables. All other sectors, including formerly unexplained sectors, well jointly ganger-cause New York State employment growth. The significance of export' F value is totally changed between before and after 2001. Before recession, exports granger-cause employment for the construction, professional and business services, and government sectors. However, after recession, exports granger-cause NYS employment in the manufacturing, trade and transportation, finance, and leisure and hospitality sectors. Information and finance sectors appear to be granger-caused from US total and sectoral employment rather than NYS total and sectoral employment. Other service sectors still appear to be localized.

Table 5-2. Granger causality test

independent / dependent	US aggregate (F value)	US sectoral (F value)	NY state aggregate (F value)	Jointly all (F value)
Mining	1.085	0.144	2.753**	1.385
Construction	1.964	3.623**	1.455	4.362**
Manufacturing	1.739	3.281**	1.948	4.328**
Trade,transportation, utilities	0.482	0.116	5.450*	3.230**
Information	1.189	6.073**	2.879**	7.036**
Finance	1.209	3.505**	3.454**	4.522**
Profession, business	2.740**	6.542**	4.927**	5.693**
Education, health	1.455	3.693**	3.034**	3.007**
Leisure, hospitality	0.150	0.148	5.120**	2.978**
Other services	1.657	1.225	8.470**	5.599**
Government	0.110	1.459	2.441*	1.728*

*: reject the null hypothesis of zero coefficients at 10% confidence interval, which means Granger-causality exists.
**: reject the null hypothesis of zero coefficients at 5% confidence interval, which means Granger-causality exists.

Table 5-3. Granger causality test with state export (F value)

independent / dependent	US aggregate	US sectoral	NY state export	NY state Aggregate	Jointly all
Mining	0.223	0.988	1.205	0.374	0.591
Construction	1.994*	4.763**	1.872*	3.998**	3.466**
Manufacturing	1.040	2.782**	0.857	2.973**	2.477**
Trade,transportation, utilities	0.468	0.989	1.970*	1.413	1.548*
Information	2.880**	1.987*	1.594	1.536	3.167**
Finance	1.284	1.768	2.654**	1.384	2.530**
Profession, business	1.209	2.388**	0.867	0.879	1.662**
Education, health	1.189	2.201**	1.787	3.336**	1.857**
Leisure, hospitality	0.331	1.287	0.539	2.589**	1.542*
Other services	1.937*	0.598	1.693	3.751**	2.044**
Government	2.2207**	3.8603**	1.0052	2.2386**	2.0412**

*: reject the null hypothesis of zero coefficients at 10% confidence interval, which means Granger-causality exists.
**: reject the null hypothesis of zero coefficients at 5% confidence interval, which means Granger-causality exists.

Table 5-4. Granger Causality Test with State Export (1996.1-2000.12)

independent / dependent	US aggregate	US sectoral	NY state export	NY state aggregate	Jointly all
Mining	1.244	2.230*	3.101**	1.859	1.986*
Construction	2.542*	5.199**	2.708**	3.393**	3.953**
Manufacturing	1.095	2.107*	0.970	1.372	1.427
Trade,transportation, utilities	2.027	2.027*	1.702	3.316**	1.958*
Information	1.934	4.043**	1.281	2.274*	2.748**
Finance	0.573	0.549	0.862	0.780	0.741
Profession, business	8.304**	6.658**	3.257**	1.556	4.537**
Education, health	1.424	0.528	1.798	1.222	1.438
Leisure, hospitality	1.401	0.949	0.754	2.902**	1.774*
Other services	1.157	0.131	1.366	3.520**	2.116*
Government	3.157**	6.395**	6.730**	4.435**	4.591**

*: reject the null hypothesis of zero coefficients at 10% confidence interval, which means Granger-causality exists.
**: reject the null hypothesis of zero coefficients at 5% confidence interval, which means Granger-causality exists.

Table 5-5. Granger Causality Test with State Export (2001.1-2006.7)

independent / dependent	US aggregate	US sectoral	NY state export	NY state aggregate	Jointly all
Mining	0.407	1.143	2.149*	0.983	1.076
Construction	2.831**	4.188**	1.339	2.295*	3.256**
Manufacturing	2.751**	3.336**	2.120*	3.824**	4.905**
Trade, transportation, utilities	1.617	1.155	2.128*	1.957*	1.565
Information	2.266*	2.310*	1.193	1.510	3.152*
Finance	3.914**	1.145	6.938**	3.331	4.999**
Profession, business	0.819	1.913	0.554	0.985	1.645*
Education, health	2.786*	2.786*	0.430	7.883**	4.190**
Leisure, hospitality	0.825	1.996*	2.649**	1.699	2.134**
Other services	1.576	0.737	3.757**	3.909**	2.276**
Government	3.597**	4.433**	4.790**	5.204**	4.676**

*: reject the null hypothesis of zero coefficients at 10% confidence interval, which means Granger-causality exists.

**: reject the null hypothesis of zero coefficients at 5% confidence interval, which means Granger-causality exists.

5.3.2. Baseline Sectoral Model

While the Granger-causality results are suggestive, looking at them can be misleading because of the simultaneous, dynamic nature of the equations. The individual coefficients from VAR estimation and usual summary measurements for VAR estimation, such as variance decomposition and impulse response function, can provide more information on causal relationship. Table 5-6 presents coefficients in baseline VAR estimation. In most industries, national sectoral employment appears to have positive relationship with local sectoral employment in NYS. Local aggregate employment has positive relationship with local sectoral employment, especially in longer time lags.

Table 5-7 shows variance decomposition for each industry sector in a baseline VAR estimation. The shares of the variance caused by US sectoral shock, US aggregate shock, NY sectoral shock, and NY aggregate shock are presented with the time horizon of 1 month, 12 months, 36 months and longer time horizon of 60 months. According to the result, NY sectoral shocks explain most of the employment fluctuations in sectoral employment in New York State, both short-term and long term, while US aggregate shocks explain just a small fraction of total forecasting variance. It implies that local shocks contribute most of the sectoral employment fluctuations in New York State compared to national shocks, as sectoral shocks explain more fluctuations compared to aggregate shocks. In most industrial sectors, regional sectoral shocks explain over 80% of sectoral employment fluctuations. Among industrial sectors, they contribute larger portions to the mining, government, leisure and hospitality sectors, explaining more than 90% of the variance of employment fluctuations. Although national sectoral shocks contribute less than 1% in most sectors, they explain more than 10% of the variance in professional and business, manufacturing, and construction.

Table 5-6. Coefficient in Baseline VAR Model

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	)(-3)
1.Mining	-0.333	-0.070	-0.055	1.700	1.299	0.082	0.035	0.167	-0.116	-2.777	0.453	0.057
	(0.073)	(0.077)	(0.072)	(0.754)	(0.759)	(0.751)	(0.292)	(0.291)	(0.293)	(1.665)	(1.673)	(1.658)
2.Construction	0.120	-0.063	0.013	-0.077	0.168	0.758	0.288	0.479	-0.045	-1.727	1.288	0.338
	(0.092)	(0.091)	(0.091)	(0.372)	(0.375)	(0.368)	(0.172)	(0.169)	(0.171)	(0.796)	(0.810)	(0.767)
3.Manufacturing	-0.140	0.060	0.056	0.106	-0.097	0.226	0.149	0.173	0.248	0.617	-0.126	-0.199
	(0.086)	(0.084)	(0.084)	(0.120)	(0.120)	(0.118)	(0.137)	(0.133)	(0.135)	(0.276)	(0.276)	(0.272)
4.Trade, transportation,	-0.119	0.095	-0.037	0.159	0.083	0.629	-0.247	-0.099	-0.078	0.195	0.343	-0.077
utilities	(0.105)	(0.106)	(0.104)	(0.162)	(0.163)	(0.159)	(0.203)	(0.206)	(0.201)	(0.336)	(0.329)	(0.316)
5.Information	-0.504	-0.298	-0.208	0.194	0.749	0.891	0.032	0.278	0.847	-0.958	1.428	-0.329
	(0.090)	(0.090)	(0.085)	(0.380)	(0.381)	(0.388)	(0.245)	(0.231)	(0.230)	(0.830)	(0.848)	(0.857)
6.Finance	0.009	-0.071	-0.261	0.068	0.026	0.572	0.212	-0.455	0.695	0.518	0.229	-0.260
	(0.083)	(0.083)	(0.083)	(0.185)	(0.182)	(0.180)	(0.253)	(0.269)	(0.250)	(0.346)	(0.349)	(0.344)
7.Profession, business	-0.006	-0.027	0.055	-0.044	0.187	0.594	0.551	0.280	0.153	-0.930	0.358	-0.273
	(0.086)	(0.088)	(0.086)	(0.155)	(0.160)	(0.158)	(0.144)	(0.148)	(0.144)	(0.373)	(0.375)	(0.369)
8.Education, health	-0.080	-0.023	-0.136	-0.145	-0.122	0.144	0.025	0.207	0.368	0.214	0.178	-0.282
	(0.076)	(0.076)	(0.078)	(0.080)	(0.080)	(0.079)	(0.134)	(0.137)	(0.138)	(0.174)	(0.177)	(0.172)
9.Leisure, hospitality	-0.233	-0.112	-0.071	0.163	0.704	0.669	0.022	-0.060	0.098	0.184	-0.190	-0.205
	(0.088)	(0.089)	(0.087)	(0.228)	(0.228)	(0.225)	(0.177)	(0.177)	(0.179)	(0.495)	(0.481)	(0.487)
10.Other services	0.042	-0.030	-0.153	-0.298	0.073	0.771	0.059	-0.060	0.300	-0.099	0.654	-0.348
	(0.085)	(0.085)	(0.086)	(0.162)	(0.164)	(0.164)	(0.190)	(0.194)	(0.186)	(0.302)	(0.302)	(0.297)
11.Government	-0.182	-0.174	-0.293	0.048	-0.129	0.498	0.008	0.332	0.014	-0.066	0.116	-0.199
	(0.085)	(0.087)	(0.086)	(0.195)	(0.194)	(0.192)	(0.159)	(0.159)	(0.158)	(0.417)	(0.422)	(0.412)

Table 5-7. Variance Decomposition for Baseline VAR Model

	Share of variance due to			
	US aggregate	US sectoral	NY state aggregate	NY state sectoral
Mining				
1month	0	0	0	1
12 month	0.014121	0.001503	0.021873	0.962503
36 month	0.015002	0.001712	0.022875	0.960412
60 month	0.015028	0.001727	0.022899	0.960345
Construction				
1month	0	0	0	1
12 month	0.028432	0.115741	0.046396	0.809431
36 month	0.033071	0.127207	0.050777	0.788946
60 month	0.033217	0.127505	0.050899	0.788379
Manufactuing				
1month	0	0	0	1
12 month	0.029664	0.116943	0.062438	0.790955
36 month	0.035262	0.144999	0.073662	0.746076
60 month	0.035656	0.146893	0.074442	0.743009
Trade, transport, util.				
1month	0	0	0	1
12 month	0.027863	0.01592	0.102457	0.853759
36 month	0.033547	0.025602	0.107331	0.83352
60 month	0.033749	0.02595	0.107493	0.832809
Information				
1month	0	0	0	1
12 month	0.040984	0.049683	0.045372	0.863961
36 month	0.050935	0.05221	0.052669	0.844186
60 month	0.051532	0.052331	0.053173	0.842963
Finance				
1month	0	0	0	1
12 month	0.026275	0.04757	0.064147	0.862008
36 month	0.035481	0.055575	0.07178	0.837164
60 month	0.036179	0.056055	0.07233	0.835436
Professional, business				
1month	0	0	0	1
12 month	0.027599	0.204458	0.038876	0.729067
36 month	0.026049	0.236644	0.037132	0.700174
60 month	0.026005	0.2376	0.03708	0.699315
Education, health				
1month	0	0	0	1
12 month	0.02306	0.048884	0.033386	0.89467
36 month	0.023335	0.050194	0.035264	0.891206
60 month	0.023375	0.050268	0.035388	0.890969
Leisure, hospitality				
1month	0	0	0	1
12 month	0.015609	0.003396	0.074438	0.906557
36 month	0.022873	0.00404	0.078082	0.895005
60 month	0.0231	0.004062	0.078194	0.894644
Other services				
1month	0	0	0	1
12 month	0.037102	0.021216	0.120167	0.821515
36 month	0.045032	0.022458	0.123664	0.808845
60 month	0.045314	0.022463	0.123832	0.808392
government				
1month	0	0	0	1
12 month	0.001637	0.030664	0.034417	0.933282
36 month	0.002181	0.030701	0.034856	0.932262
60 month	0.002222	0.030704	0.034881	0.932194

In other words, in NY State, no US shock invokes a larger response than the NY aggregate shocks or NY sectoral shocks. For instance, in manufacturing, US aggregate shocks account for 3% and US manufacturing shocks account for 11.7%, while NY State aggregate shocks take 6.3% and NY State's own manufacturing shocks take 79%. NY State shocks are over 10 times larger than US aggregate shocks or US manufacturing shocks.

The cumulative impulse response functions are presented in Figure 5-1 to Figure 5-4 for the impact of each shock on NY State total employment. Each figure contains 11 response functions indicating the dynamic path of total New York employment after one standard deviation shock to each sector variable. The middle solid line represents the point estimate, and the shadow area represents 95% confidence interval over 36 months.

The impulse response functions suggest several points. First, shocks to employment growth in most sectors tend to have significant and permanent effects on total New York State employment growth. Second, while the effect of US aggregate shocks and US sectoral shocks to NY State employment tend to increase for most of sectors, there is a negative effect of US sectoral shocks on NY state employment in mining, education and health, and government sectors. Negative effect among these sectors suggests that NY State and the US would have different economic mechanisms, or at least no linkage between the two. NYS employment growth responds relatively strongly to US sectoral shocks to manufacturing, construction, trade, information, and professional services in terms of magnitude and duration.

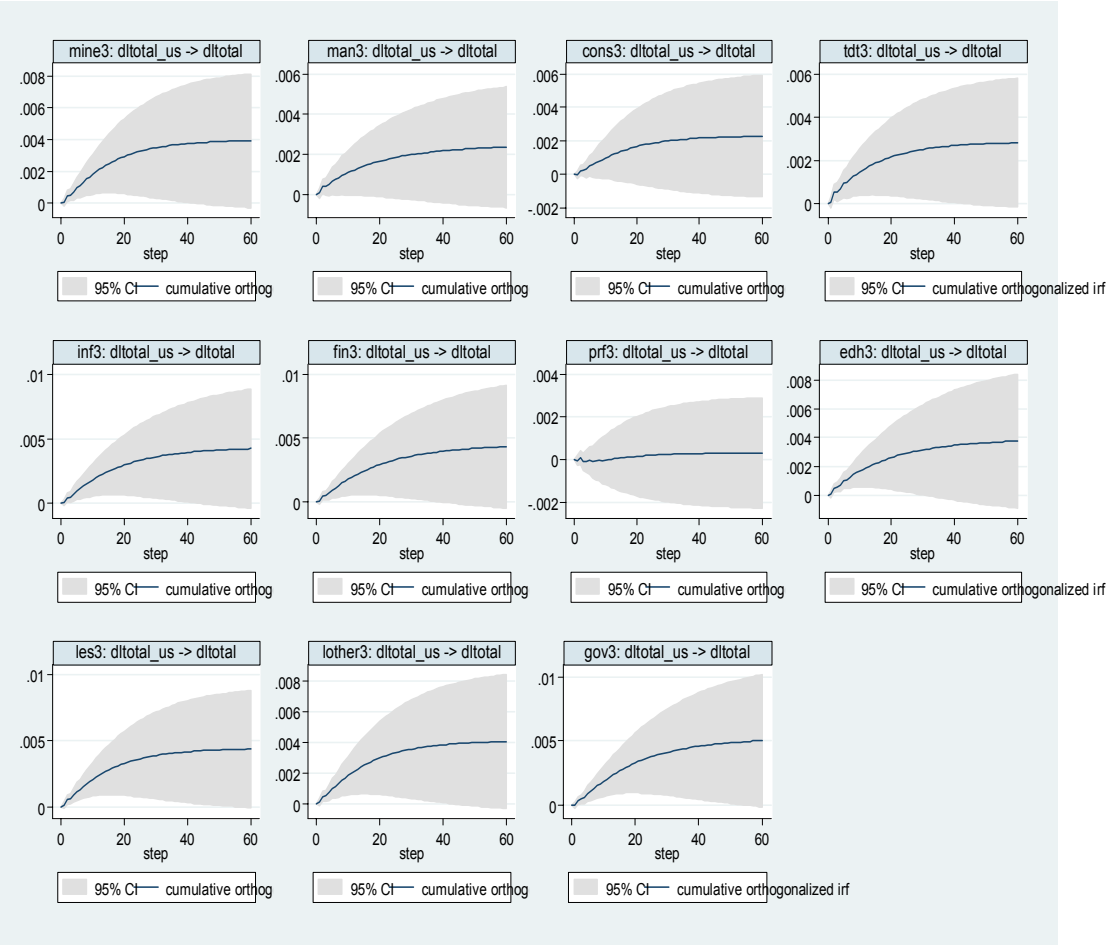


Figure 5-1. The Effect of US Aggregate Shocks on NYS Employment

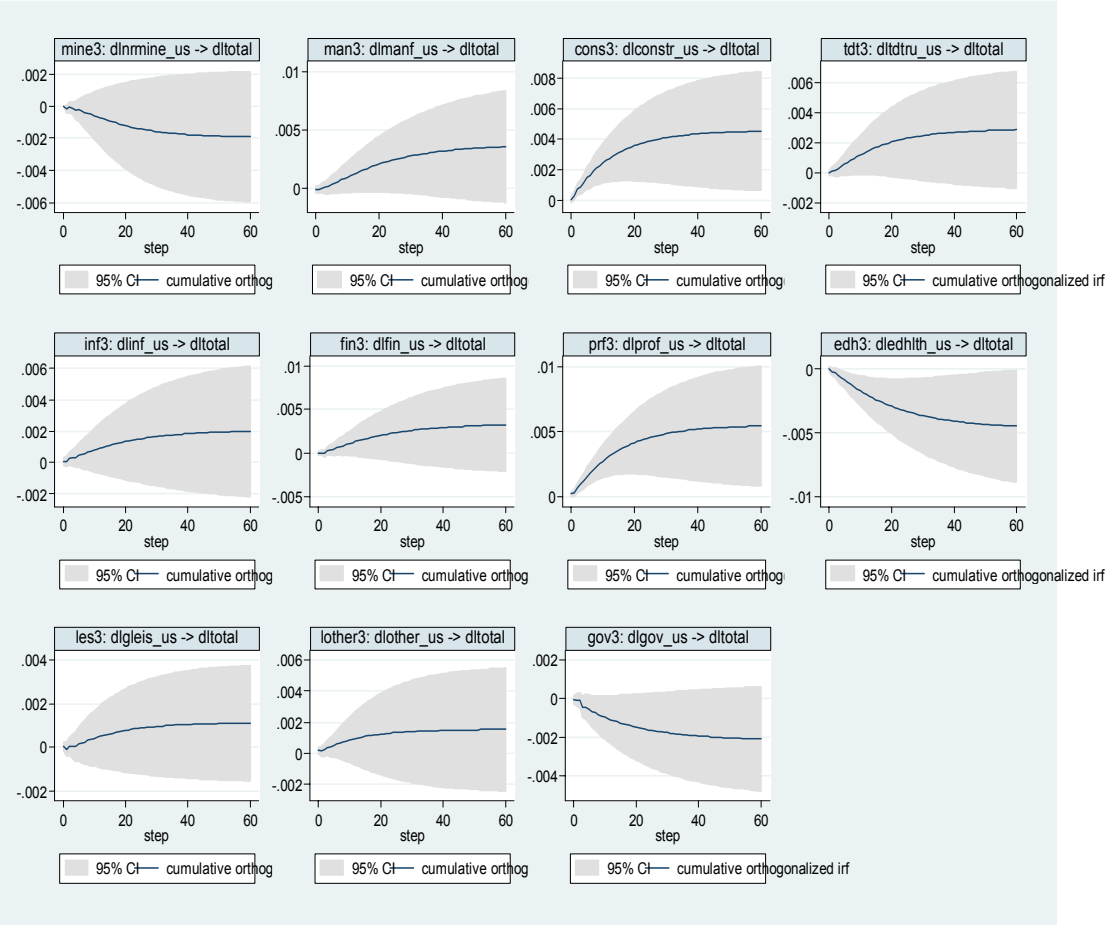


Figure 5-2. The Effect of US Sectoral Shocks on NYS Employment

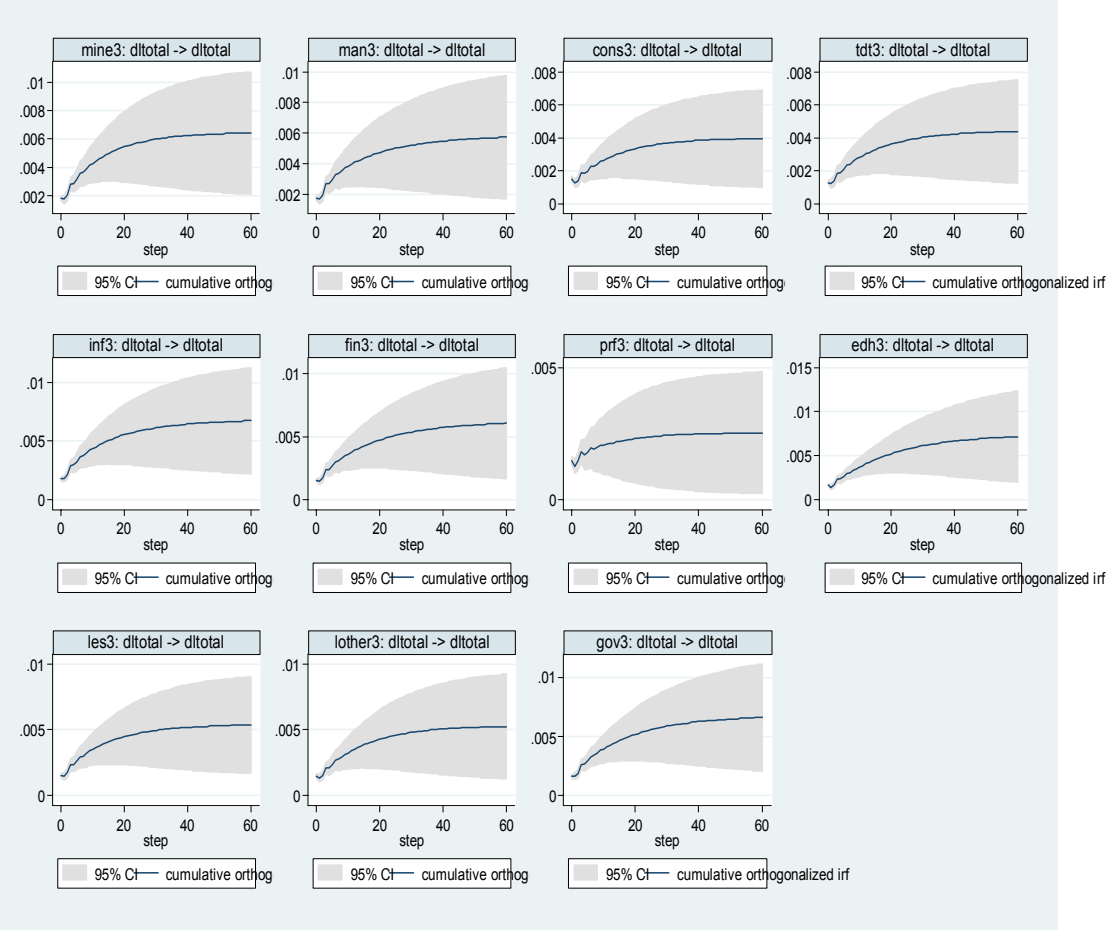


Figure 5-3. The Effect of NYS Aggregate Shocks on NYS Employment

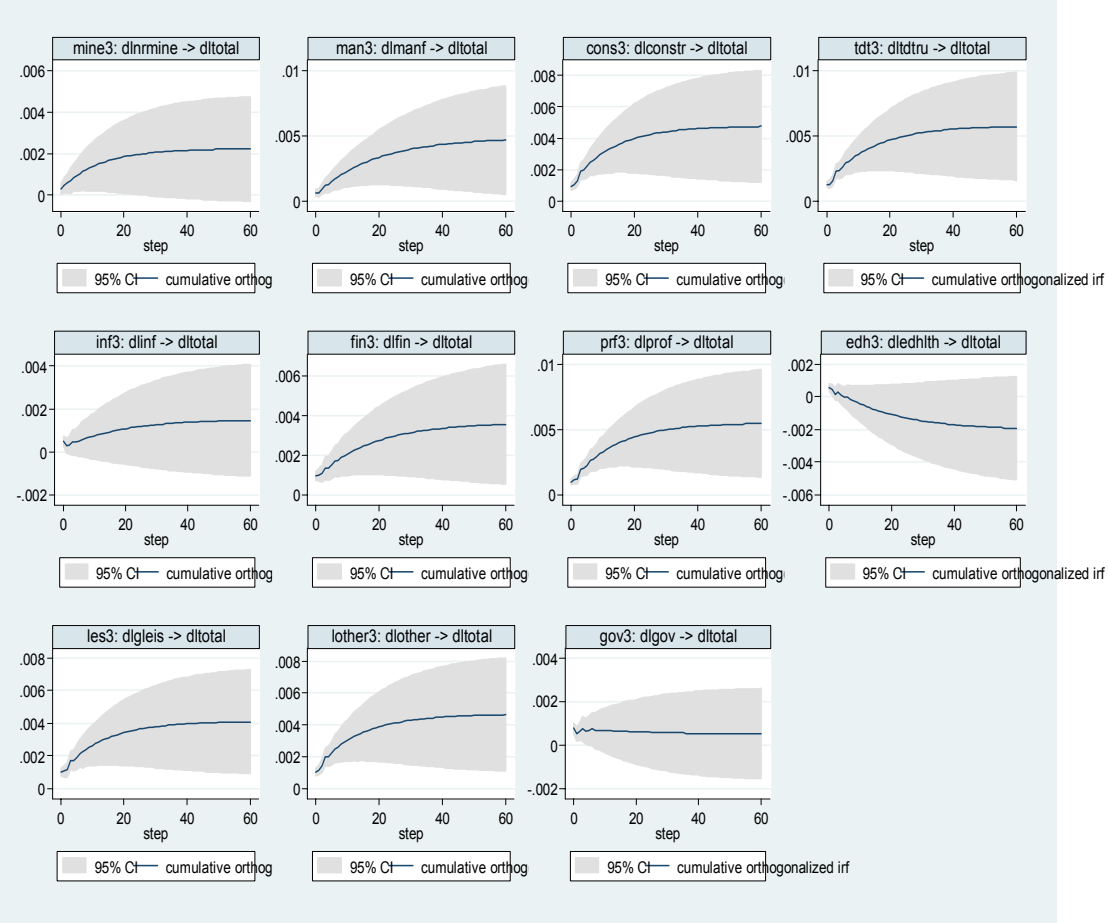


Figure 5-4. The Effect of NYS Sectoral Shocks on NYS Employment

5.3.3. Baseline Sectoral Model with Time Split

The next model separates data for the period before (1996-2000) and after the economic recession (2001 to 2006). Table 5-8 presents coefficients in a baseline VAR estimation before economic recession, and Table 5-9 presents coefficients after economic recession. Table 5-10 shows variance decomposition for each industry sector before economic recession (1996-2000), and Table 5-11 shows variance decomposition after economic recession (2001 to 2006). Comparing before and after recession, national shock becomes more important after recession than before recession. This is more conspicuous in some industrial sectors, such as manufacturing, education and health, information, government, and finance. Before recession, basic implications are similar to that of the total sample: regional sectoral shocks explain most of NY State employment fluctuations, while national shocks explain only small portion of the fluctuations.

In the manufacturing sector, regional sectoral shock explains 84% of the variance before economic recession (1996-2000), while it explains 50% of the variance after recession (2001-2006). The contribution of national sectoral shock increases from 12% to 35% after recession, implying that overall declines in the manufacturing sector become an important factor explaining NY State manufacturing employment after recession, as well as declines in total NY state employment. In the government sector, the contribution of national aggregate shock conspicuously increases from 0.1% to 12%, implying that economic recession plays some important role in NY state employment in the government sector. In education and health, both national sectoral shock and regional aggregate shock become more important after recession than before recession. Regional sectoral shock explains 91% of the variance in NY State employment in the education and industr before recession, but explains only 59% of the variance after recession. In information and finance sectors,

the influence of regional aggregate shock increases from 4.7% and 7.4% to 15.2% and 12.3%, respectively, implying that the declines in total employment in NY State after recession affected industrial employment in those sectors. One possible explanation for this may be that the information and financé industries are highly correlated to the performance of other industrial sectors, suggesting possible cross-industry effect.

In sum, variance decomposition before and after recession suggests several possibilities in explaining sectoral employment fluctuations in NY State and contribution of the industrial sectors to NY total employment fluctuations. Some industries show different patterns before and after recession in explaining the employment fluctuations in those sectors. Overall, the contribution of NY State aggregate shock, US sectoral shock and US aggregate shock are increased after recession, suggesting the possibilities of cross-industry effect. The importance of national shock increases in explaining sectoral employment fluctuations after recession.

Figure 5-5 to Figure 5-8 represent the cumulative response functions for the impact of each shock on the NYS total employment before recession, for the period of 1996-2000. Surprisingly, most of shocks appear not to permanently impact NYS total employment during the period. Only NYS aggregate shocks, in most industries, impact NYS total employment with positive correlation. That is, in order to promote economic employment growth for the period before 2001, it would have been necessary to implement a policy that focused on NYS rather than the US, or on the sectors of NYS leisure and hospitality and other services. However, as was seen before, the general explanation of the causality is weak.

Table 5-8. Coefficient in Baseline VAR Model (1996.1~2000.12)

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)
1.Mining	-0.340	0.067	-0.087	1.765	0.877	0.197	-0.070	0.082	-0.420	-2.056	1.354	1.295
	(0.090)	0.098)	(0.091)	(0.947)	(0.947)	(0.943)	(0.376)	(0.365)	(0.377)	(0.141)	(2.111)	(2.200)
2.Construction	0.157	0.072	-0.000	0.122	0.089	1.099	0.139	0.345	-0.107	-1.168	2.155	0.318
	(0.121)	(0.120)	(0.121)	(0.543)	(0.540)	(0.531)	(0.239)	(0.237)	(0.235)	(1.212)	(1.185)	(1.172)
3.Manufacturing	-0.128	0.204	0.180	0.022	0.206	0.044	0.045	-0.077	0.137	0.959	-0.083	0.132
	(0.111)	(0.105)	(0.106)	(0.154)	(0.150)	(0.150)	(0.181)	(0.180)	(0.174)	(0.348)	(0.354)	(0.354)
4.Trade,	-0.205	0.088	-0.101	0.235	0.118	0.821	-0.048	-0.241	-0.132	0.368	0.855	0.169
transportation, utilities	(0.126)	(0.129)	(0.126)	(0.199)	(0.200)	(0.198)	(0.257)	(0.259)	(0.248)	(0.425)	(0.413)	(0.406)
5.Information	-0.520	0.371	-0.342	0.821	1.524	1.169	-0.451	-0.055	0.982	-2.284	0.876	-0.264
	(0.124)	(0.124)	(0.114)	(0.538)	(0.539)	(0.535)	(0.360)	(0.355)	(0.353)	(1.076)	(10.85)	(1.113)
6.Finance	-0.164	2.185	-0.101	0.215	0.218	0.363	0.306	0.209	0.117	0.234	0.288	-0.050
	(0.103)	(0.103)	(0.102)	(0.166)	(0.166)	(0.164)	(0.288)	(0.308)	(0.291)	(0.328)	(0.327)	(0.334)
7.Profession, business	0.016	0.016	0.187	0.016	0.105	0.554	0.644	0.234	0.260	-1.382	0.613	-0.550
	(0.091)	(0.091)	(0.088)	(0.157)	(0.165)	(0.162)	(0.158)	(0.164)	(0.157)	(0.375)	(0.388)	(0.387)
8.Education, health	-0.097	0.158	-0.083	0.144	-0.036	0.008	-0.142	0.175	0.424	0.329	-0.075	-0.155
	(0.097)	(0.100)	(0.103)	(0.101)	(0.100)	(0.099)	(0.170)	(0.174)	(0.174)	(0.216)	(0.214)	(0.225)
9.Leisure, hospitality	-0.355	0.196	-0.080	0.252	0.471	0.781	-0.002	-0.034	0.366	0.722	0.392	-0.583
	(0.103)	(0.106)	(0.104)	(0.227)	(0.227)	(0.224)	(0.186)	(0.188)	(0.193)	(0.515)	(0.503)	(0.513)
10.Other services	0.043	0.004	-0.213	0.199	0.082	0.040	-0.135	-0.333	0.395	-0.182	1.109	-0.521
	(0.108)	(0.106)	(0.109)	(0.228)	(0.223)	(2.226)	(0.259)	(0.259)	(0.252)	(0.419)	(0.408)	(0.424)
11.Government	-0.202	0.207	-0.351	0.017	0.060	0.589	0.189	0.298	-0.099	-0.055	0.008	0.379
	(0.110)	(0.118)	(0.116)	(0.258)	(0.258	(0.261)	(0.196)	(0.200)	(0.190)	(0.550)	(0.550)	(0.563)

Table 5-9. Coefficient in Baseline VAR Model (2001.1~2006.7)

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)
1.Mining	-0.408	-0.195	-0.030	0.187	0.100	1.200	-0.195	0.321	0.102	-2.324	1.881	0.065
	(0.124)	(0.131)	(0.120)	(1.375)	(1.462)	(1.382)	(0.527)	(0.551)	(0.488)	(3.042)	(3.147)	(2.901)
2.Construction	-0.053	-0.017	-0.234	-0.088	0.026	-0.003	0.337	0.458	-0.307	-0.883	0.759	1.026
	(0.126)	(0.122)	(0.118)	0.355	(0.380)	(0.361)	(0.231)	(0.225)	(0.240)	(0.872)	(0.877)	(0.779)
3.Manufacturing	-0.119	-0.235	-0.200	0.219	0.166	0.595	0.183	0.618	0.258	-0.029	0.153	-0.883
	(0.134)	(0.130)	(0.131)	(0.192)	(0.211)	(0.197)	(0.234)	(0.254)	(0.247)	(0.453)	(0.441)	(0.431)
4.Trade, transportation,	0.264	0.206	0.091	-0.365	0.060	-0.040	0.222	0.161	0.019	0.021	-0.221	0.378
utilities	(0.187)	(0.190)	(0.193)	(0.282)	(0.291)	(0.276)	(0.295)	(0.296)	(0.302)	(0.512)	(0.501)	(0.475)
5.Information	-0.320	-0.167	0.030	-0.093	0.965	1.722	0.535	0.666	-0.020	-0.082	-1.104	-0.012
	(0.118)	(0.126)	(0.124)	(0.542)	(0.577)	(0.553)	(0.357)	(0.345)	(0.345)	(1.355)	(1.313)	(1.131)
6.Finance	-0.002	-0.106	-0.548	0.082	0.304	1.144	0.379	-0.961	1.074	1.465	-0.085	-0.010
	(0.162)	(0.157)	(0.157)	(0.535)	(0.544)	(0.530)	(0.468)	(0.481)	(0.449)	(0.826)	(0.829)	(0.767)
7.Profession, business	-0.043	-0.143	0.362	-0.418	0.063	0.798	0.512	0.746	0.069	0.340	-1.217	0.638
	(0.216)	(0.215)	(0.220)	(0.466)	(0.461)	(0.457)	(0.286)	(0.285)	(0.284)	(0.849)	(0.837)	(0.822)
8.Education, health	0.073	0.204	-0.324	-0.145	-0.145	0.537	0.469	0.008	0.259	-0.495	0.796	-0.595
	(0.105)	(0.089)	(0.093)	(0.111)	(0.116)	(0.116)	(0.172)	(0.197)	(0.192)	(0.271)	(0.282)	(0.235)
9.Leisure, hospitality	-0.057	-0.135	-0.204	-0.218	1.417	0.501	0.522	-0.048	-0.573	-1.722	-0.310	0.949
	(0.166)	(0.178)	(0.160)	(0.613)	(0.659)	(0.596)	(0.375)	(0.364)	(0.353)	(1.147)	(1.170)	(1.095)
10.Other services	-0.105	-0.079	-0.394	-0.262	0.300	0.492	0.159	0.262	-0.151	0.279	-0.081	-0.285
	(0.134)	(0.147)	(0.142)	(0.209)	(0.247)	(0.225)	(0.244)	(0.252)	(0.232)	(0.401)	(0.413)	(0.349)
11.Government	-0.240	-0.168	-0.214	-0.321	-0.660	-0.273	-0.535	0.508	0.424	0.911	0.908	-0.919
	(0.125)	(0.126)	(0.128)	(0.283)	(0.287)	(0.259)	(0.315)	(0.342)	(0.337)	(0.602)	(0.633)	(0.543)

Table 5-10. Variance decomposition for Baseline Model (1996. 1 ~ 2000. 12)

	Share of variance due to			
	US aggregate	US sectoral	NY state aggregate	NY state sectoral
Mining				
1month	0	0	0	1
12 month	0.016229	0.009343	0.023971	0.950458
36 month	0.017787	0.00957	0.025646	0.946996
60 month	0.017815	0.009574	0.025675	0.946936
Construction				
1month	0	0	0	1
12 month	0.029848	0.127369	0.055079	0.787704
36 month	0.030552	0.14954	0.05748	0.762428
60 month	0.030564	0.149899	0.057515	0.762021
Manufactuing				
1month	0	0	0	1
12 month	0.082164	0.032126	0.04252	0.843189
36 month	0.088028	0.035068	0.04849	0.828414
60 month	0.088179	0.035141	0.048641	0.828038
Trade, transportation, util.				
1month	0	0	0	1
12 month	0.059697	0.021181	0.170818	0.748303
36 month	0.066336	0.028612	0.176344	0.728708
60 month	0.066514	0.028806	0.176477	0.728204
Information				
1month	0	0	0	1
12 month	0.041371	0.063715	0.047805	0.847108
36 month	0.044032	0.063349	0.052402	0.840217
60 month	0.044101	0.063338	0.052513	0.840048
Finance				
1month	0	0	0	1
12 month	0.019513	0.063738	0.07402	0.842729
36 month	0.019503	0.109707	0.079699	0.791091
60 month	0.019388	0.114194	0.079844	0.786574
Professional, business				
1month	0	0	0	1
12 month	0.087592	0.248436	0.044277	0.619696
36 month	0.081561	0.292905	0.042476	0.583058
60 month	0.081363	0.294484	0.042394	0.581759
Education, health				
1month	0	0	0	1
12 month	0.022367	0.051189	0.013287	0.913157
36 month	0.023929	0.053622	0.017083	0.905366
60 month	0.024132	0.053899	0.017528	0.904441
Leisure, hospitality				
1month	0	0	0	1
12 month	0.046681	0.020368	0.123746	0.809206
36 month	0.057323	0.022329	0.133948	0.786401
60 month	0.057586	0.022379	0.134194	0.785842
Other services				
1month	0	0	0	1
12 month	0.066054	0.027252	0.140228	0.766467
36 month	0.073415	0.031564	0.144317	0.750704
60 month	0.073686	0.031712	0.144457	0.750145
Government				
1month	0	0	0	1
12 month	0.009971	0.026649	0.057998	0.905383
36 month	0.013255	0.026751	0.060571	0.899422
60 month	0.013435	0.026757	0.060682	0.899126

Table 5-11. Variance Decomposition for Baseline Model (2000. 1 ~ 2006. 7)

Sources Horizon	Share of variance due to			
	US aggregate	US sectoral	NY state aggregate	NY state sectoral
Mining				
1month	0	0	0	1
12 month	0.017061	0.003987	0.024557	0.954394
36 month	0.017163	0.003984	0.025492	0.953361
60 month	0.017163	0.003984	0.025495	0.953358
Construction				
1month	0	0	0	1
12 month	0.046368	0.11008	0.022341	0.821212
36 month	0.047285	0.111166	0.025514	0.816035
60 month	0.047295	0.111172	0.025547	0.815985
Manufactuing				
1month	0	0	0	1
12 month	0.038348	0.349912	0.111497	0.500243
36 month	0.041732	0.392974	0.108499	0.456795
60 month	0.041845	0.394389	0.108399	0.455367
Trade, transportation, util.				
1month	0	0	0	1
12 month	0.003999	0.036832	0.023522	0.935647
36 month	0.003985	0.039816	0.023001	0.933197
60 month	0.003985	0.039832	0.022999	0.933184
Information				
1month	0	0	0	1
12 month	0.035594	0.065737	0.151954	0.746715
36 month	0.038773	0.067396	0.158855	0.734977
60 month	0.038793	0.067407	0.158902	0.734898
Finance				
1month	0	0	0	1
12 month	0.047319	0.052491	0.12418	0.77601
36 month	0.048585	0.05318	0.126748	0.771486
60 month	0.048585	0.05318	0.126749	0.771486
Professional, business				
1month	0	0	0	1
12 month	0.01667	0.137816	0.043016	0.802497
36 month	0.017122	0.140101	0.042876	0.799901
60 month	0.017122	0.140101	0.042876	0.7999
Education, health				
1month	0	0	0	1
12 month	0.09468	0.123067	0.186046	0.596208
36 month	0.094734	0.124511	0.186572	0.594183
60 month	0.094735	0.124528	0.186578	0.594159
Leisure, hospitality				
1month	0	0	0	1
12 month	0.046919	0.018076	0.069629	0.865376
36 month	0.047412	0.018059	0.069834	0.864694
60 month	0.047415	0.018059	0.069836	0.86469
Other services				
1month	0	0	0	1
12 month	0.012497	0.045315	0.072375	0.869813
36 month	0.012588	0.045507	0.07285	0.869055
60 month	0.012592	0.045516	0.072871	0.869021
Government				
1month	0	0	0	1
12 month	0.121791	0.086214	0.024342	0.767652
36 month	0.122402	0.08707	0.024805	0.765723
60 month	0.122408	0.08708	0.024811	0.765701

Figure 5-9 to Figure 5-12 shows the cumulative response functions after recession, for the period of 2001-2006. Although the contribution of each shock shows different patterns in some industrial employment from the pre-recession period, the contribution of each shock to NYS total employment after recession shows a similar pattern to that of the pre-recession period. NYS aggregate shock is conspicuous in most industries.

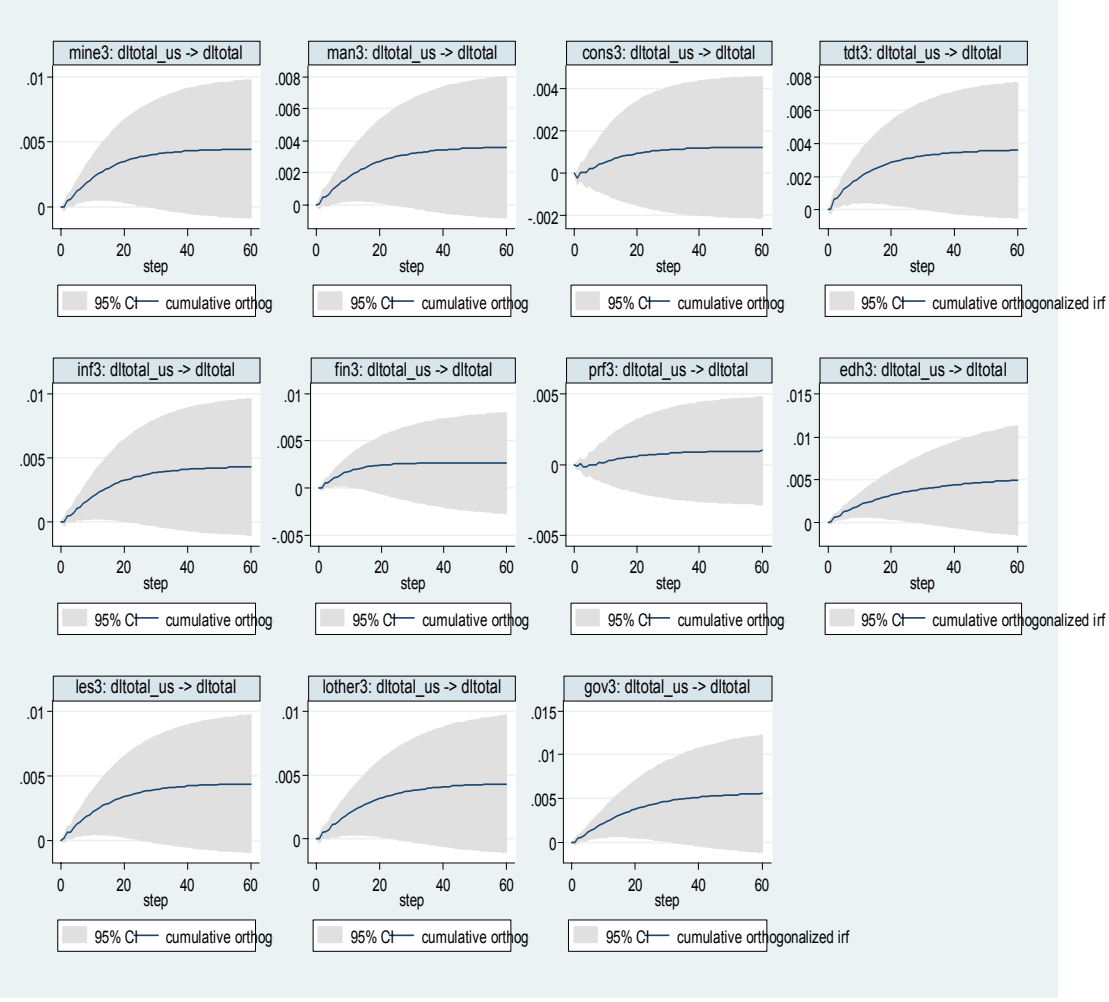


Figure 5-5. The Effect of US Aggregate Shocks on NYS Employment (1996.1-2000.12)

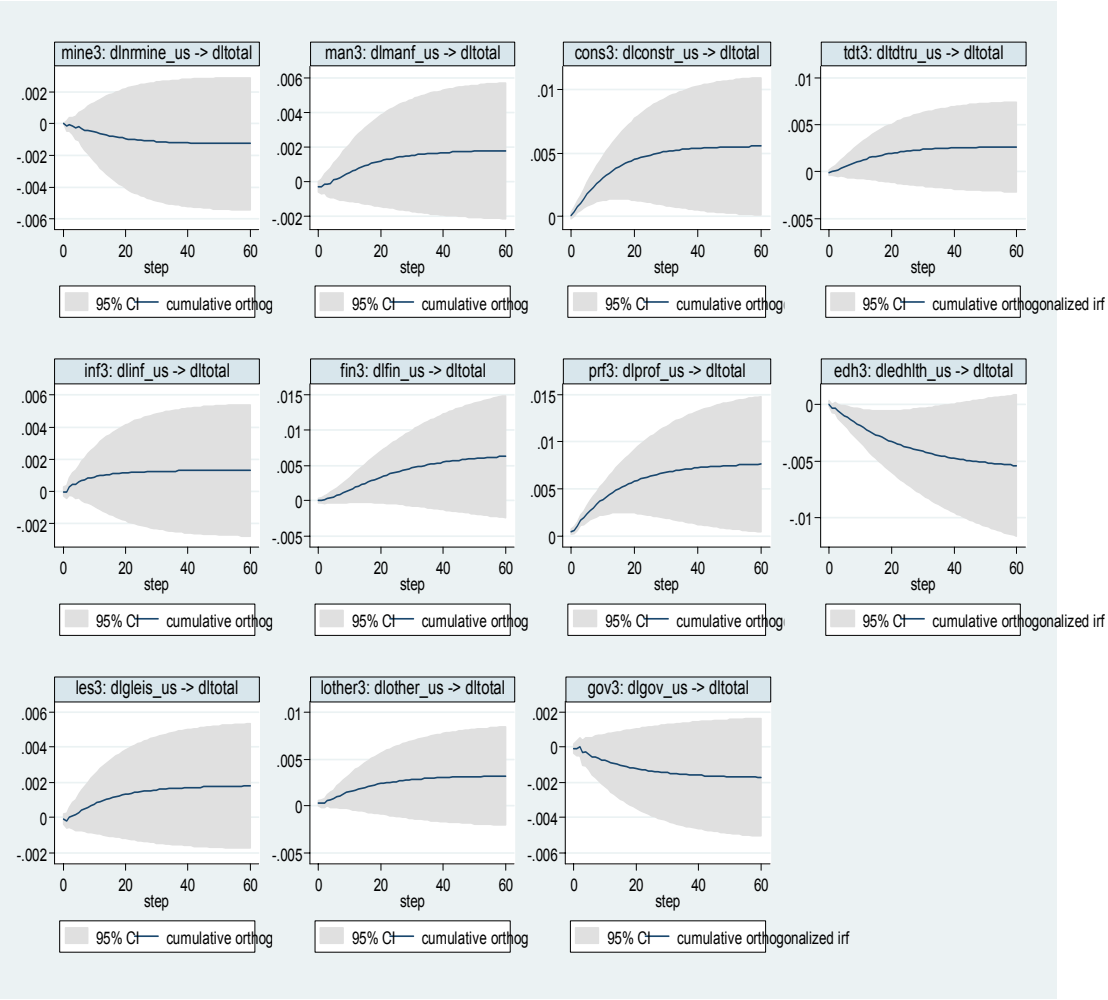


Figure 5-6. The Effect of US Sectoral Shocks on NYS Employment (1996.1-2000.12)

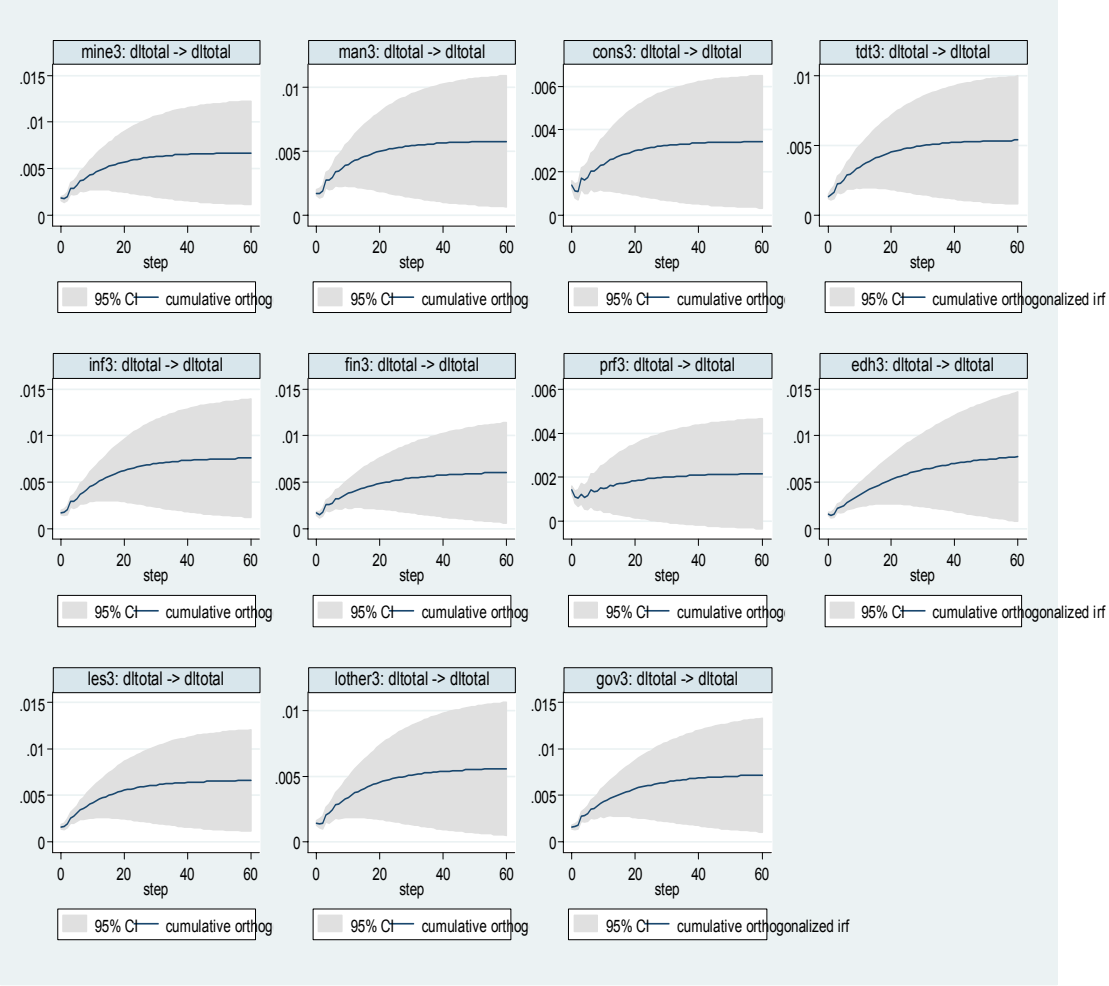


Figure 5-7. The Effect of NYS Aggregate Shocks on NYS Employment (1996.1-2000.12)

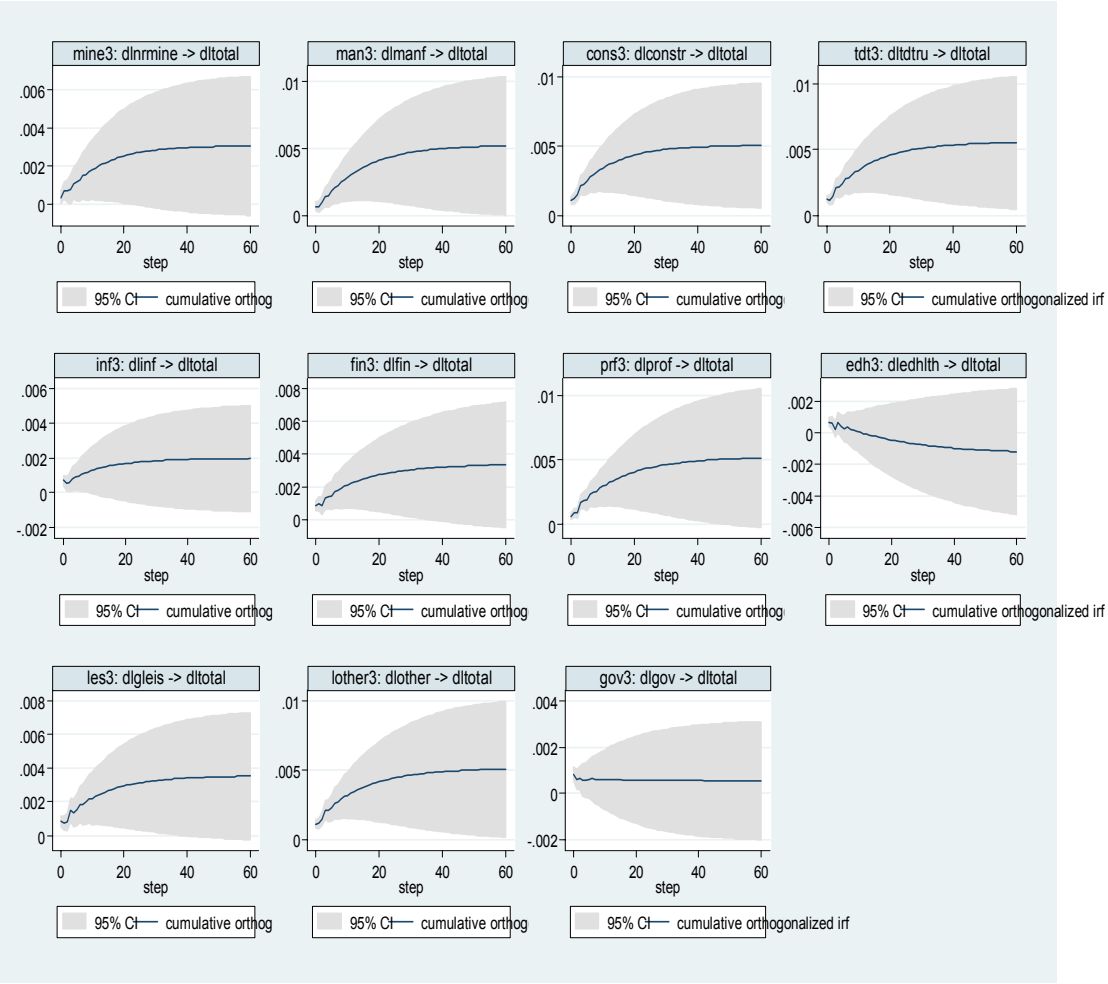


Figure 5-8. The Effect of NYS Sectoral Shocks on NYS Employment (1996.1-2000.12)

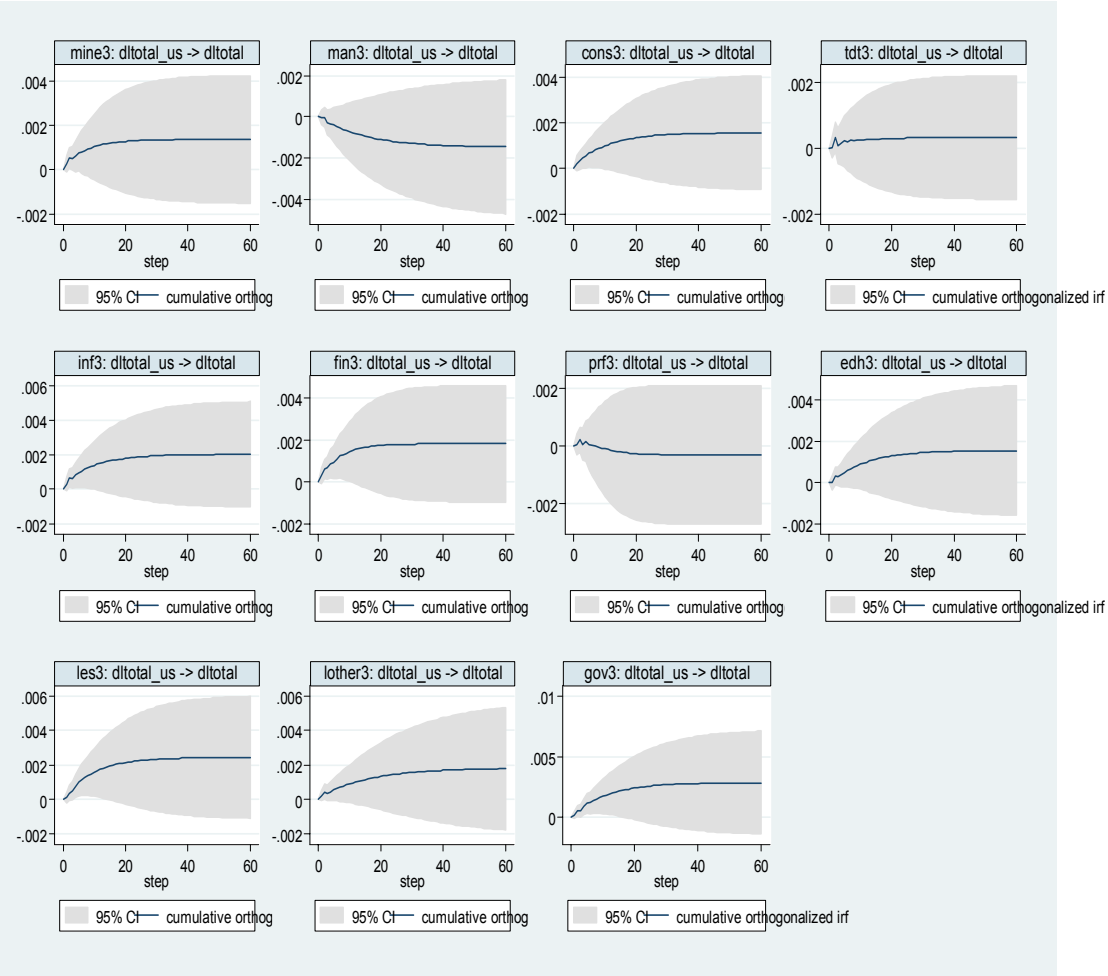


Figure 5-9. The Effect of US Aggregate Shocks on NYS Employment (2001.1-2006.7)

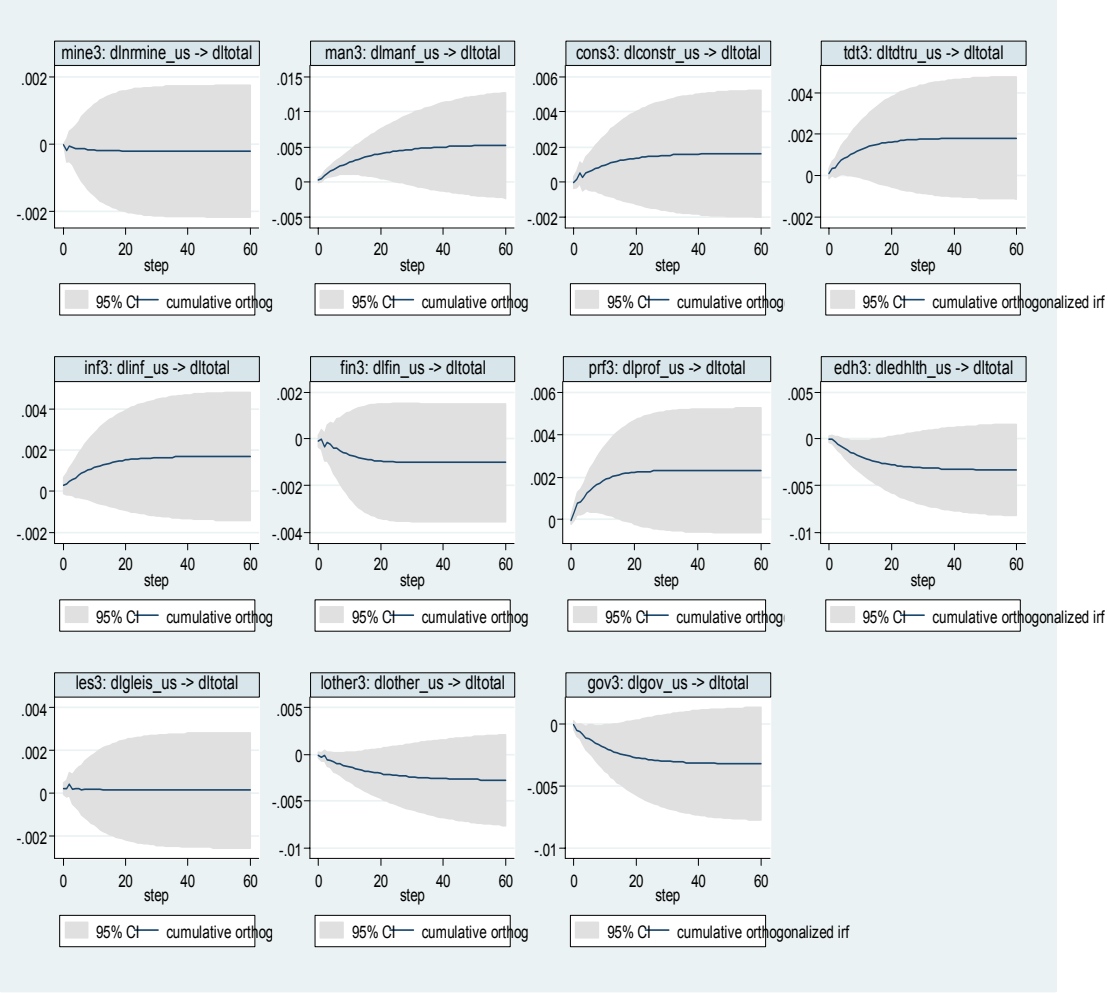


Figure 5-10. The Effect of US Sectoral Shocks on NYS Employment (2001.1-2006.7)

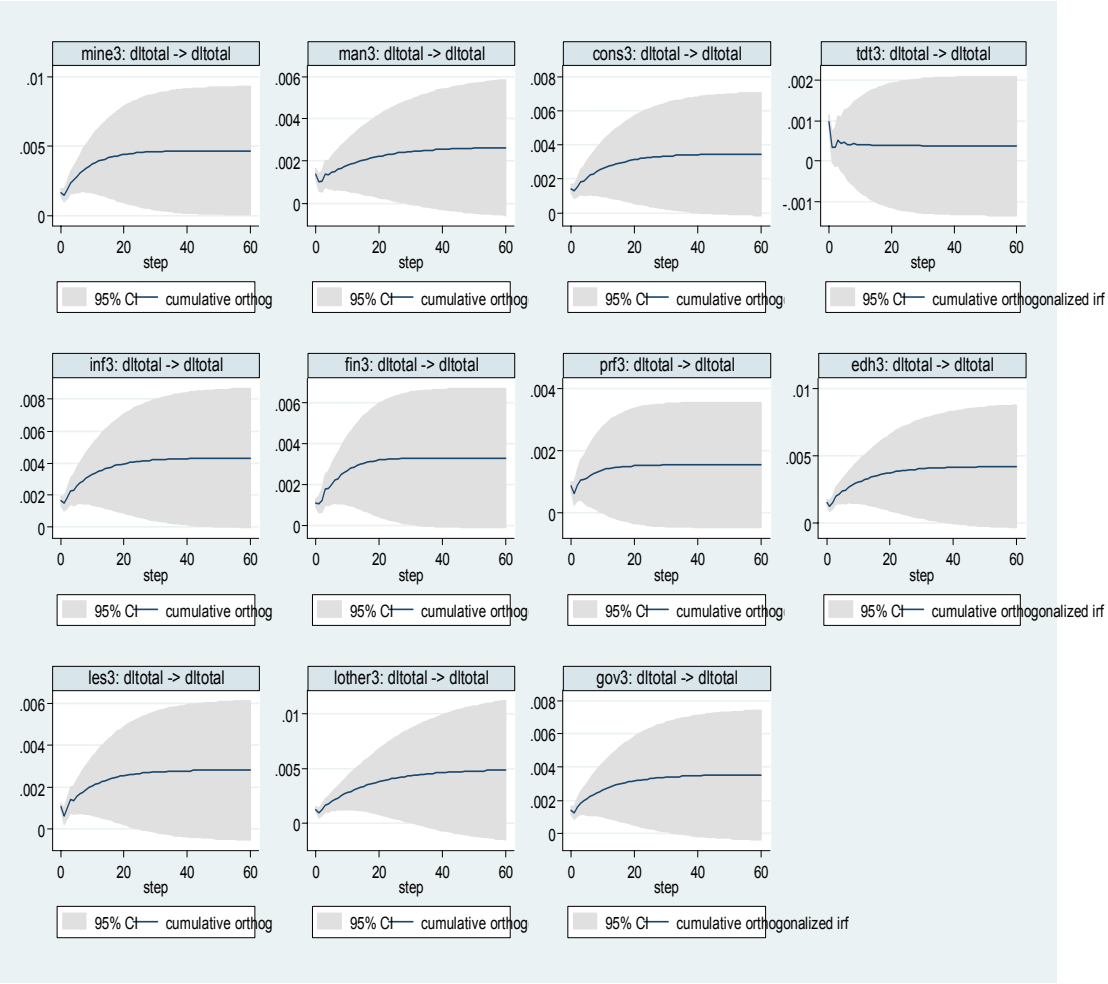


Figure 5-11. The Effect of NYS Aggregate Shocks on NYS Employment (2001.1-2006.7)

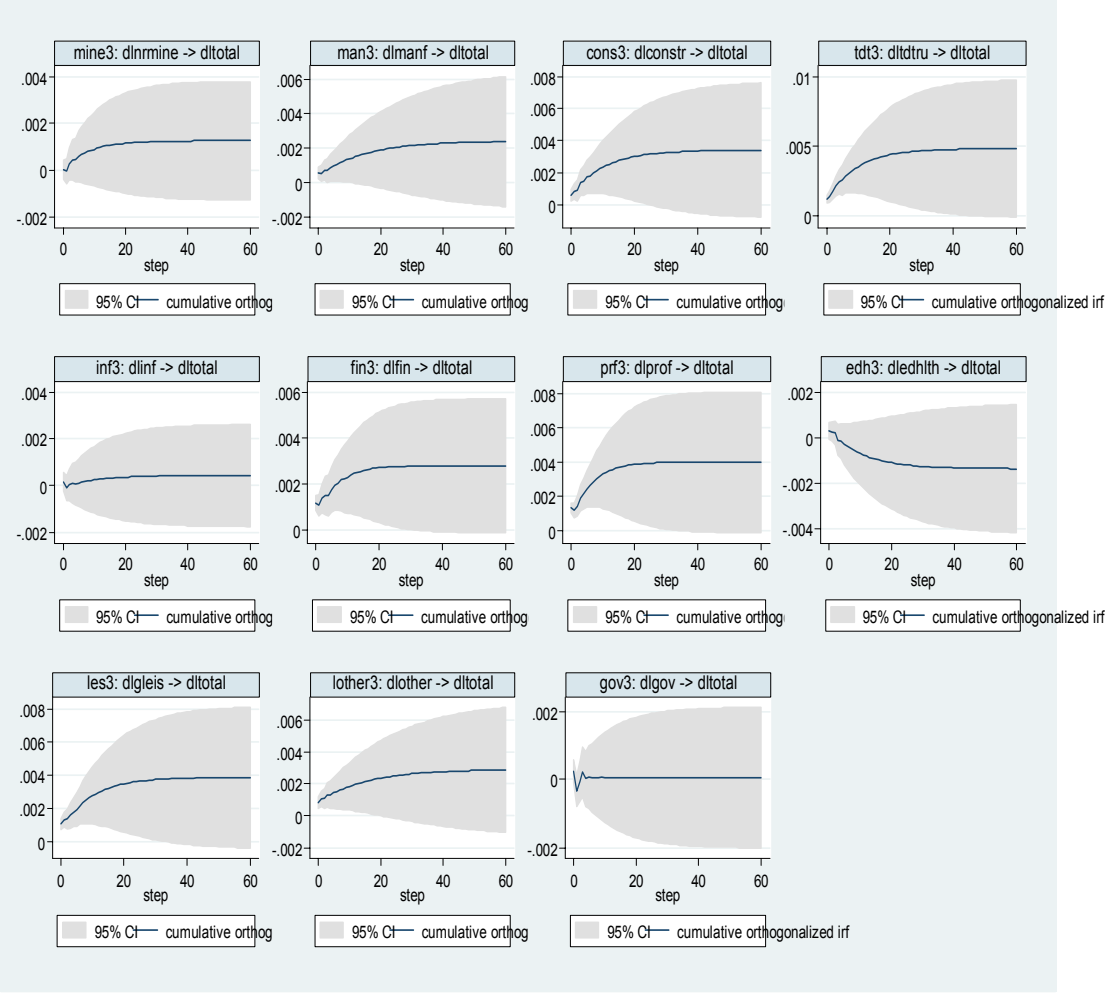


Figure 5-12. The Effect of NYS Sectoral Shocks on NYS Employment (2001.1-2006.7)

5.3.4. VAR Model with NYS Export

Table 5-12 presents coefficients in baseline VAR estimation with an addition of NYS export. Table 5-13 shows the share of employment variance due to US aggregate shock, US sectoral shock, NYS aggregate shock, NYS sectoral shock, and NYS export. Adding NY State export to the baseline model, however, does not change major implications or the variance decomposition of each shock. The implication is similar: regional sectoral shocks are the main source of industrial employment fluctuations, and national shocks are relatively less important source of fluctuations. The government sector, however, shows some increases in the importance of national sectoral shock. The share of US sectoral shock increases from 3% in baseline model to 11%.

Figure 5-13 to Figure 5-17 present the impact of each shock on total NY State employment, with the inclusion of export, providing several findings. Firstly, US shocks and NY shocks tend to have similar effects on total NY State employment, even with the inclusion of the export sector. Secondly, it's hard to say whether NY State exports impact NY State employment permanently, because the responses of confidence interval are not significantly different from zero. Instead, most sectors interact sensitively according to the fluctuation of export.

With regard to export, export shocks account for a smaller portion of employment fluctuations compared to US and NYS sectoral shocks. Less than 5 % is explained by the source of state export shock. Although export has an important role in promoting state economic development, the role of export in explaining the fluctuations of employment tends to be weak in every sector. Combining the result from cumulative response function, New York State employment fluctuates sensitively according to export change, but the relative amount of fluctuation from

export is less than from other US shocks and NY State shocks.

Table 5-12. Coefficient in VAR Model with Export

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	)
1.Mining	-0.426	-0.087	-0.050	-0.130	0.187	0.409	-1.517	0.391	1.056	0.090	0.342	-0.296
	(0.091)	(0.097)	(0.086)	(0.982)	(1.009)	(0.979)	(1.956)	(2.002)	(1.971)	(0.359)	(0.371)	(0.356)
2.Construction	-0.113	-0.070	0.124	-0.115	0.258	-0.118	0.178	0.306	-0.436	-0.841	2.072	1.369
	(0.096)	(0.096)	(0.098)	0.364	(0.379)	(0.364)	(0.202)	(0.201)	(0.198)	(0.797)	(0.800)	(0.742)
3.Manufacturing	-0.090	-0.082	-0.085	-0.005	-0.175	0.478	0.128	0.216	0.388	0.503	0.084	-0.216
	(0.112)	(0.110)	(0.109)	(0.152)	(0.156)	(0.156)	(0.159)	(0.154)	(0.159)	(0.323)	(0.326)	(0.322)
4.Trade, transportation,	-0.145	0.007	0.086	0.032	0.240	0.410	-0.417	0.083	0.081	0.296	0.129	-0.348
utilities	(0.124)	(0.125)	(0.123)	(0.191)	(0.190)	(0.186)	(0.232)	(0.240)	(0.241)	(0.387)	(0.381)	(0.385)
5.Information	-0.473	-0.317	0.258	0.143	0.704	1.153	-0.187	0.205	0.958	-0.153	2.111	-0.790
	(0.115)	(0.116)	(0.112)	(0.607)	(0.615)	(0.611)	(0.342)	(0.330)	(0.322)	(1.206)	(1.215)	(1.247)
6.Finance	0.056	-0.095	-0.328	-0.219	0.159	0.604	0.257	-0.954	0.811	1.010	0.064	-0.094
	(0.106)	(0.104)	(0.105)	(0.291)	(0.289)	(0.282)	(0.334)	(0.359)	(0.330)	(0.469)	(0.477)	(0.474)
7.Profession, business	0.108	-0.043	0.040	-0.347	0.010	0.227	0.319	0.361	0.184	0.040	0.196	-0.126
	(0.118)	(0.125)	(0.128)	(0.219)	(0.232)	(0.227)	(0.177)	(0.178)	(0.172)	(0.456)	(0.456)	(0.450)
8.Education, health	-0.015	0.266	-0.265	-0.183	-0.075	0.330	0.014	0.348	0.349	0.049	0.145	-0.327
	(0.094)	(0.095)	(0.098)	(0.114)	(0.117)	(0.115)	(0.175)	(0.181)	(0.184)	(0.229)	(0.232)	(0.217)
9.Leisure, hospitality	-0.149	-0.042	-0.150	-0.216	0.816	0.436	0.161	0.034	-0.413	-0.178	-0.417	0.467
	(0.106)	(0.110)	(0.104)	(0.322)	(0.325)	(0.317)	(0.249)	(0.239)	(0.254)	(0.624)	(0.580)	(0.617)
10.Other services	0.056	-0.079	-0.069	-0.460	-0.002	0.589	0.009	0.333	0.029	0.294	0.698	-0.483
	(0.099)	(0.010)	(0.102)	(0.211)	(0.222)	(0.221)	(0.247)	(0.250)	(0.243)	(0.362)	(0.363)	(0.353)
11.Government	-0.135	-0.178	-0.314	-0.178	-0.518	0.150	-0.218	0.550	0.059	0.802	0.173	-0.377
	(0.098)	(0.099)	(0.098)	(0.230)	(0.230)	(0.225)	(0.164)	(0.170)	(0.175)	(0.455)	(0.453)	(0.452)

Table 5-13. Variance Decomposition for VAR model with Export

	Share of variance due to				
	US aggregate	US sectoral	NY aggregate	NY sectoral	NY export
Mining					
1month	0	0	0	1	0
12 month	0.007	0.012	0.003	0.969	0.009
36 month	0.007	0.012	0.003	0.969	0.009
60 month	0.007	0.012	0.003	0.969	0.009
Construction					
1month	0	0	0	1	0
12 month	0.065	0.123	0.026	0.777	0.009
36 month	0.072	0.123	0.034	0.761	0.011
60 month	0.072	0.123	0.034	0.760	0.011
Manufacturing					
1month	0	0	0.009	1	0
12 month	0.024	0.118	0.152	0.707	0.007
36 month	0.025	0.141	0.163	0.665	0.006
60 month	0.025	0.143	0.164	0.662	0.006
Trade, transportation					
1month	0	0	0	1	0
12 month	0.017	0.021	0.048	0.854	0.059
36 month	0.018	0.024	0.051	0.847	0.059
60 month	0.018	0.024	0.051	0.847	0.059
Information					
1month	0	0	0	1	0
12 month	0.044	0.048	0.030	0.830	0.048
36 month	0.049	0.059	0.036	0.809	0.048
60 month	0.049	0.060	0.036	0.807	0.048
Finance					
1month	0	0	0	1	0.0366
12 month	0.036	0.059	0.069	0.766	0.0679
36 month	0.039	0.059	0.074	0.757	0.0725
60 month	0.040	0.059	0.074	0.757	0.0725
Professional, business					
1month	0	0	0	1	0
12 month	0.008	0.169	0.006	0.770	0.047
36 month	0.008	0.187	0.005	0.753	0.047
60 month	0.008	0.187	0.005	0.752	0.047
Education, health					
1month	0	0	0	1	0
12 month	0.025	0.053	0.045	0.852	0.025
36 month	0.025	0.053	0.046	0.850	0.025
60 month	0.025	0.053	0.046	0.850	0.025
Leisure, hospitality					
1month	0	0	0	1	0
12 month	0.016	0.020	0.059	0.884	0.020
36 month	0.019	0.020	0.060	0.882	0.020
60 month	0.019	0.020	0.060	0.882	0.020
Other services					
1month	0	0	0	1	0
12 month	0.047	0.042	0.100	0.781	0.030
36 month	0.049	0.043	0.102	0.776	0.031
60 month	0.049	0.043	0.102	0.776	0.031
Government					
1month	0	0	0	1	0
12 month	0.030	0.106	0.033	0.788	0.043
36 month	0.030	0.106	0.033	0.788	0.043
60 month	0.030	0.106	0.033	0.788	0.043

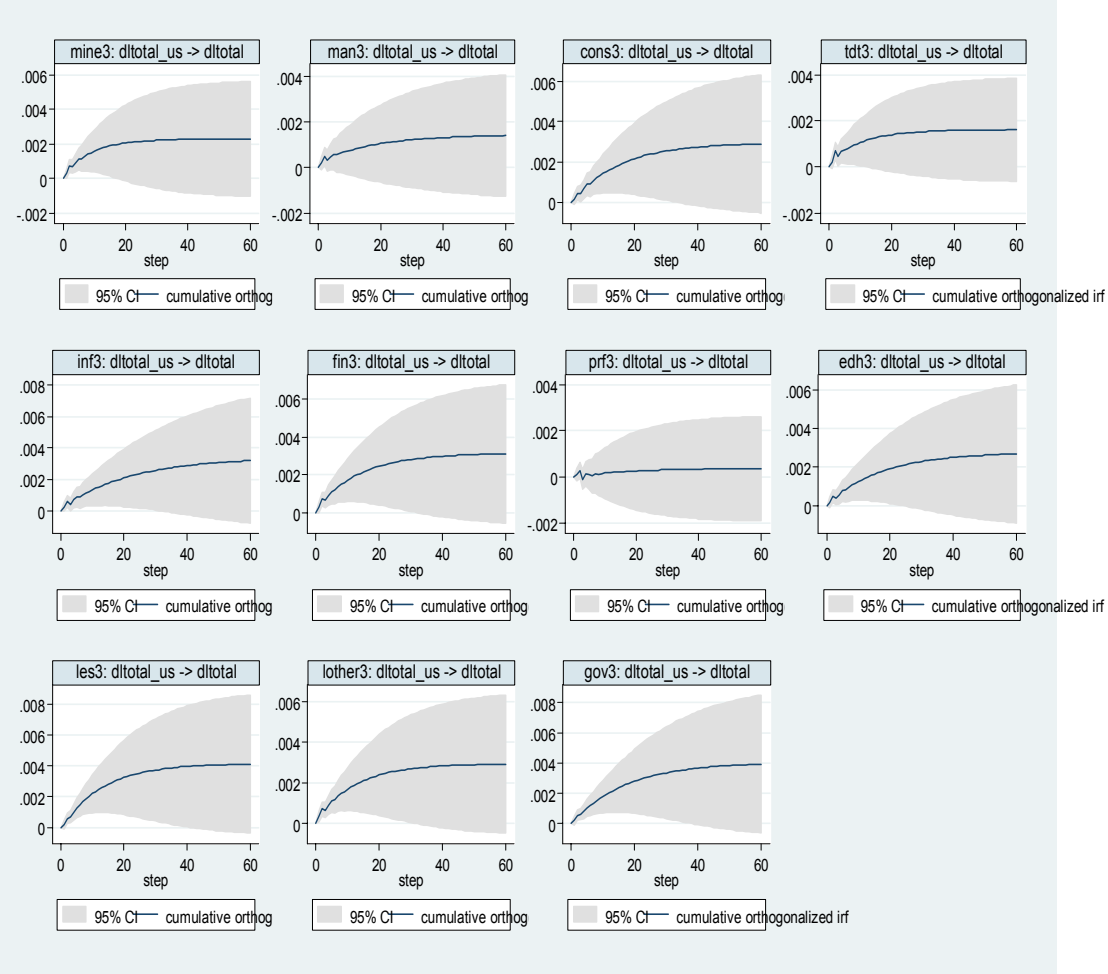


Figure 5-13. The Effect of US Aggregate Shocks on NYS Employment with State Export

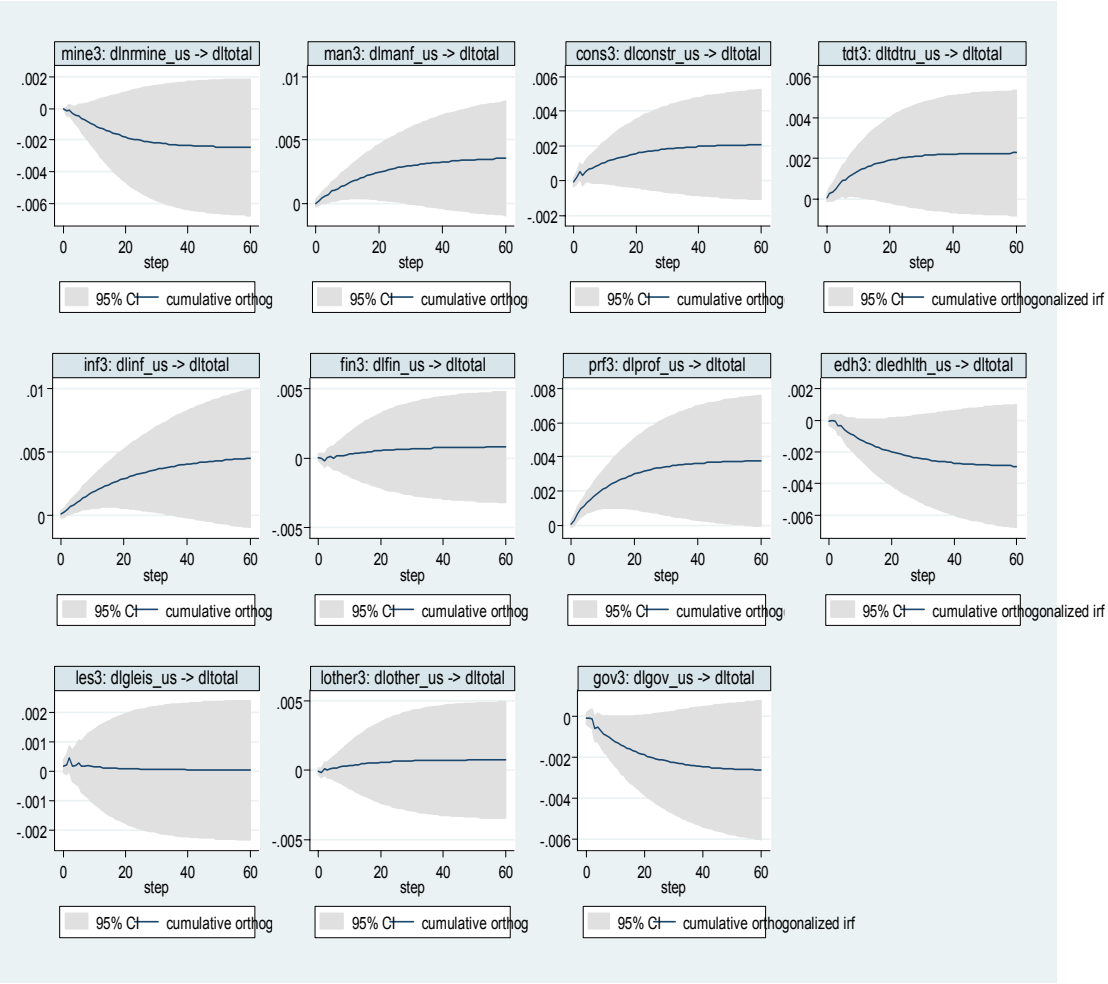


Figure 5-14. The Effect of US Sectoral Shocks on NYS Employment with State Export

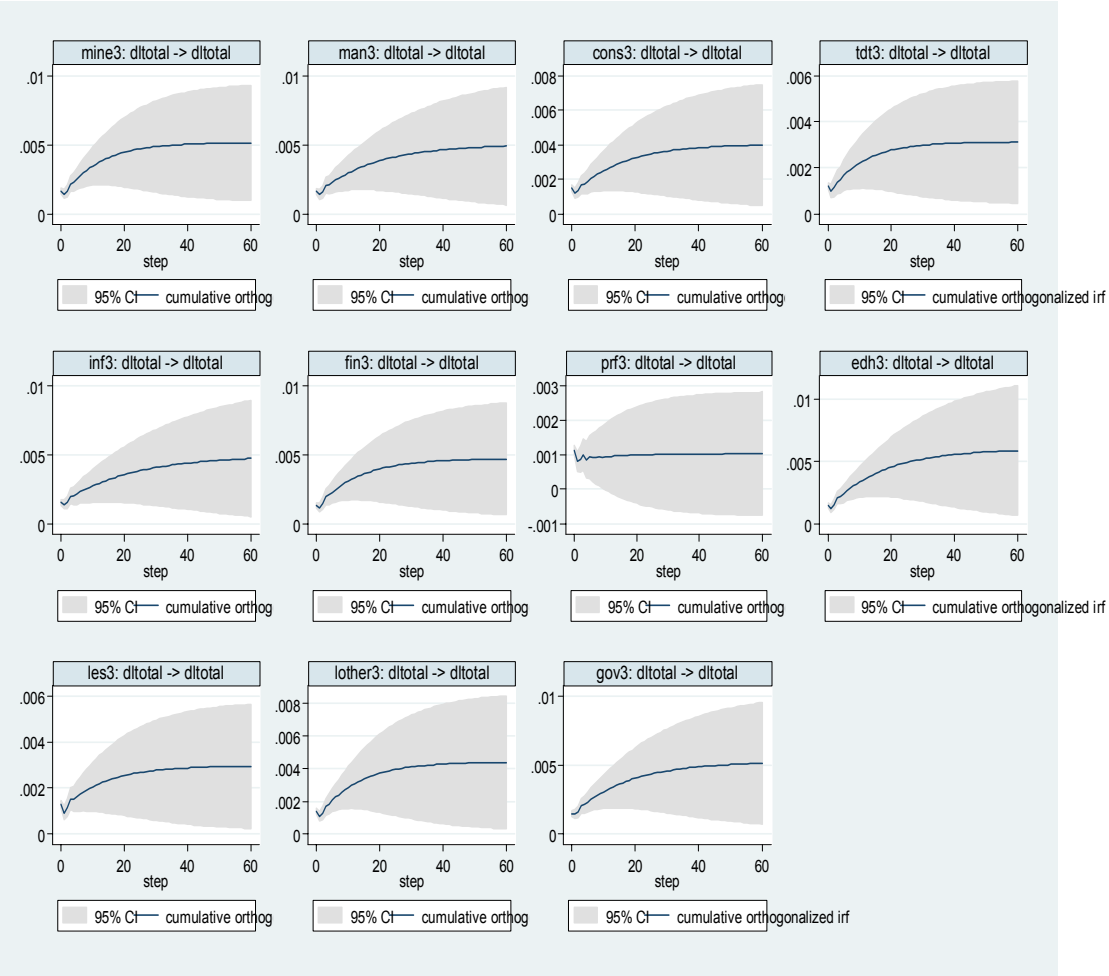


Figure 5-15. The Effect of NYS Aggregate Shocks on NYS Employment with State Export

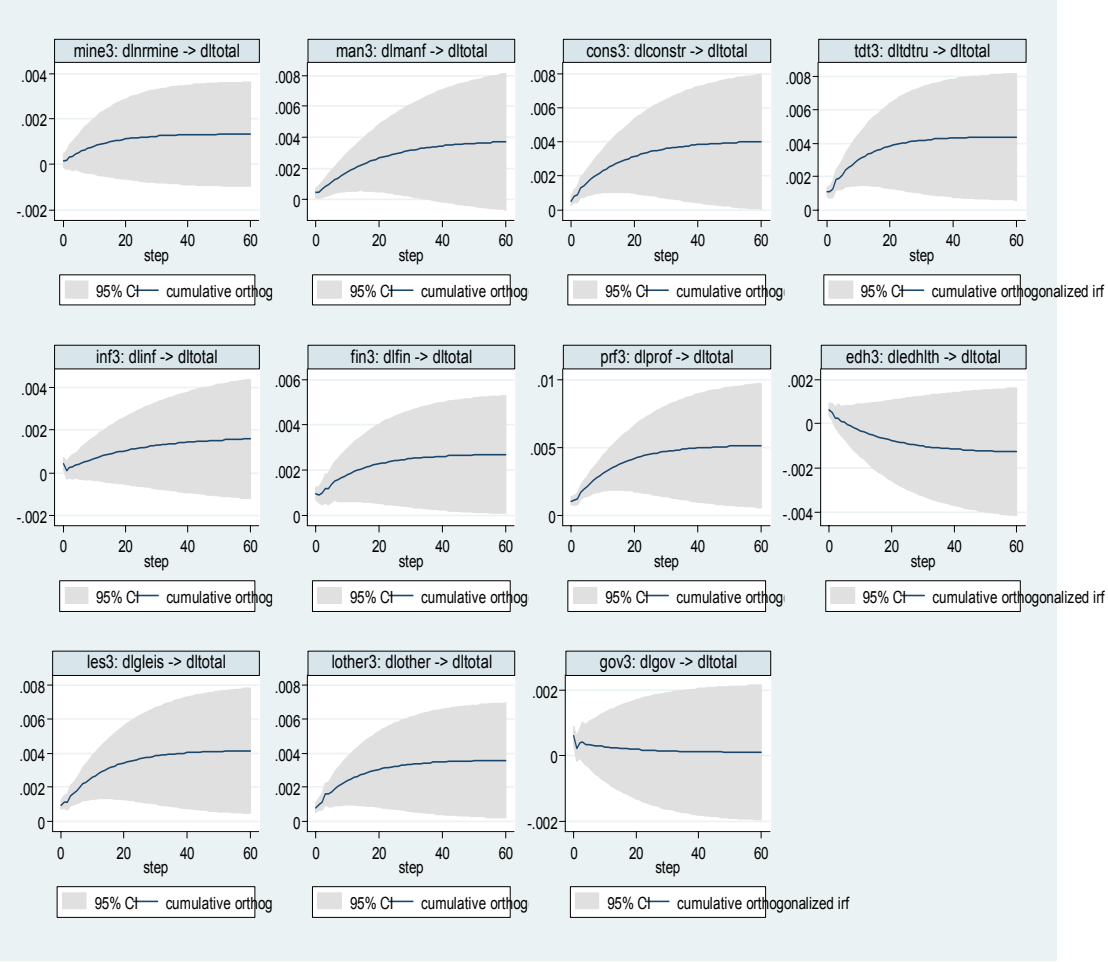


Figure 5-16. The Effect of NYS Sectoral Shocks on NYS Employment with State Export

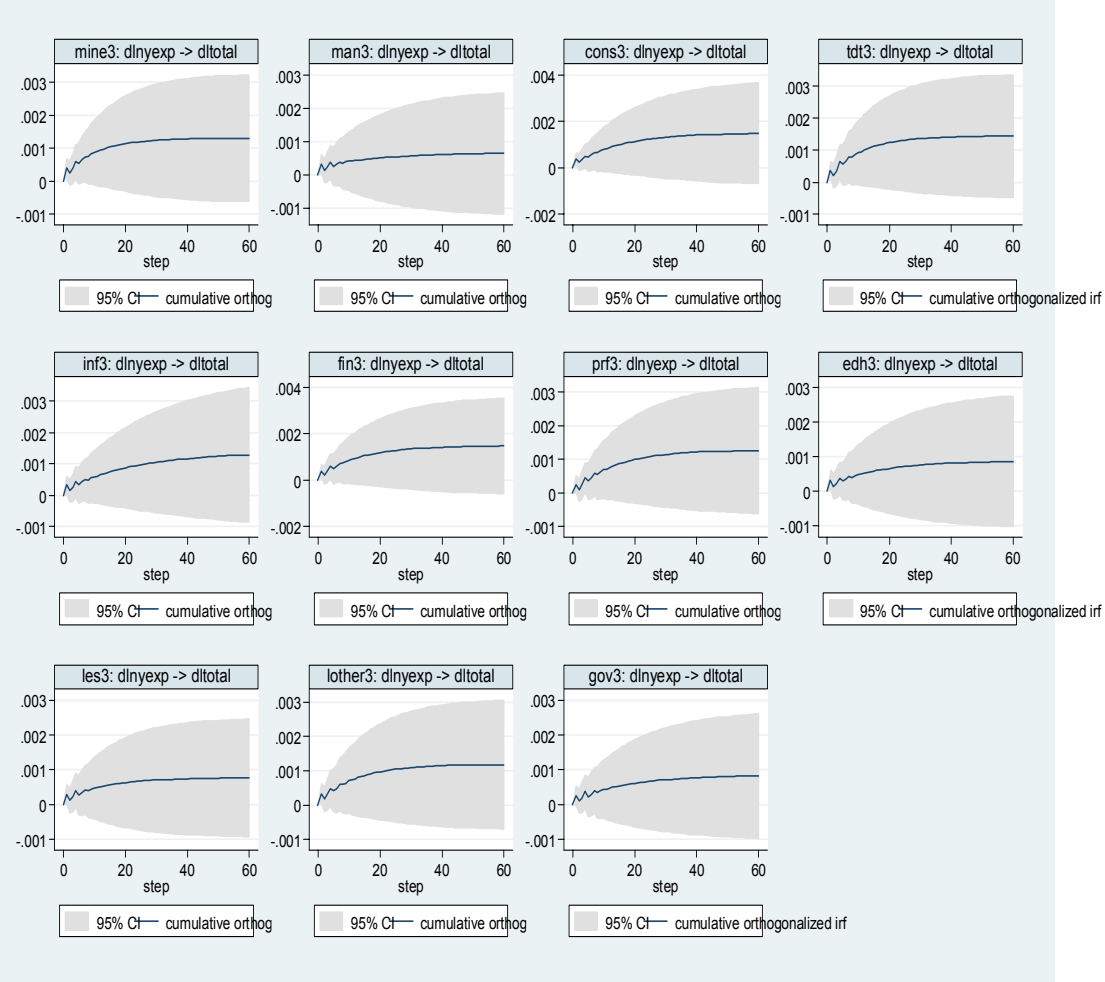


Figure 5-17. The Effect of Export Shocks on NYS Employment with State Export

5.3.5. VAR model with NYS export (Time Split)

Now, the model with export is examined before and after recession, respectively. Table 5-14 shows coefficient in VAR model with NY State export before recession (1996 – 2000), and Table 5-15 shows the coefficient after recession (2001 – 2006). Variance decompositions before and after recession are presented in Table 5-16 and Table 5-17, respectively. Similar to the baseline model with time split (5.3.b), the model with export also suggests that national shock becomes more important after recession than before recession, and industrial sectors such as manufacturing, education and health, information, government, and finance show the different pattern before and after recession. The contribution of NY State export tends to be larger when splitting the sample into before and after. NY State export explains 1% to 19% of the total NY State employment fluctuation before recession, and 1% to 15% of it. This is much larger than the whole sample without separating recession period, which NY State export explains less than 5% of the variance. Overall, the result suggests that time split is more crucial than the addition of export into the model.

In the manufacturing sector, regional sectoral shock explains 80% of the variance before economic recession (1996-2000), while it explains only 42% of the variance after recession (2001-2006). The role of export is not conspicuously changed before and after recession. Rather, as in the baseline model, national sectoral shock causes the differences before and after recession, increasing from 1.7% to 37% after recession. Again, it implies that overall declines in the manufacturing sector become an important factor explaining NY State manufacturing employment after recession, as well as declines in total NY State employment.

The government sector shows an interesting pattern in terms of changes in model specification and impulse response functions. Interestingly, the contribution of NY State export increases when the sample is split into before and after recession,

Table 5-14. Coefficient in VAR model with Export (1996.1~2000.12)

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)
1.Mining	-0.493	0.176	-0.038	-1.276	-0.936	-1.518	0.046	0.238	-1.137	-0.970	-2.460	2.679
	(0.133)	(0.143)	(0.128)	(1.438)	(1.544)	(1.467)	(0.534)	(0.549)	(0.542)	(2.921)	(2.995)	(2.940)
2.Construction	-0.176	-0.202	0.169	-0.365	-0.751	0.369	0.077	0.299	-0.382	-1.993	1.778	-0.091
	(0.134)	(0.138)	(0.141)	(0.584)	(0.594)	(0.579)	(0.287)	(0.301)	(0.293)	(1.240)	(1.290)	(1.230)
3.Manufacturing	-0.050	0.132	-0.002	0.301	-0.582	0.196	-0.057	-0.168	0.276	0.639	-0.066	0.142
	(0.185)	(0.172)	(0.173)	(0.232)	(0.238)	(0.251)	(0.244)	(0.237)	(0.243)	(0.475)	(0.485)	(0.506)
4.Trade, transportation,	-0.218	-0.059	0.147	0.057	0.151	0.673	-0.438	-0.162	0.013	0.531	0.429	-1.329
utilities	(0.162)	(0.168)	(0.163)	(0.254)	(0.252)	(0.256)	(0.351)	(0.365)	(0.343)	(0.572)	(0.556)	(0.579)
5.Information	-0.418	-0.287	-0.446	0.467	1.160	0.987	-1.177	-0.836	1.075	-2.242	0.516	-1.653
	(0.209)	(0.206)	(0.198)	(1.080)	(1.084)	(1.095)	(0.702)	(0.718)	(0.718)	(2.018)	(2.065)	(2.118)
6.Finance	-0.251	-0.295	-0.198	0.010	0.197	0.384	0.229	-0.425	0.497	0.348	-0.029	-0.057
	(0.153)	(0.155)	(0.151)	(0.291)	(0.300)	(0.290)	(0.514)	(0.577)	(0.526)	(0.508)	(0.504)	(0.511)
7.Profession, business	0.334	-0.181	0.214	-0.361	-0.154	-0.070	-0.003	-0.023	0.226	0.023	1.078	-0.490
	(0.143)	(0.145)	(0.151)	(0.168)	(0.194)	(0.197)	(0.168)	(0.167)	(0.148)	(0.372)	(0.395)	(0.140)
8.Education, health	-0.048	-0.040	-0.112	-0.239	-0.060	-0.069	-0.345	0.201	0.487	-0.027	-0.667	-0.357
	(0.142)	(0.164)	(0.161)	(0.180)	(0.197)	(0.193)	(0.282)	(0.294)	(0.284)	(0.334)	(0.333)	(0.358)
9.Leisure, hospitality	-0.271	-0.019	-0.121	-0.325	0.364	0.652	-0.296	0.120	-0.150	0.431	-0.587	-0.949
	(0.132)	(0.136)	(0.133)	(0.303)	(0.306)	(0.323)	(0.321)	(0.314)	(0.384)	(0.651)	(0.612)	(0.676)
10.Other services	0.194	-0.147	-0.056	-0.856	-0.401	0.672	-0.800	0.064	-0.153	0.384	0.841	-1.209
	(0.140)	(0.140)	(0.141)	(0.349)	(0.354)	(0.368)	(0.452)	(0.459)	(0.465)	(0.608)	(0.591)	(0.607)
11.Government	-0.126	-0.306	-0.489	-0.034	-0.224	0.559	-0.178	0.640	0.017	0.735	-0.285	-0.176
	(0.164)	(0.179)	(0.174)	(0.391)	(0.392)	(0.390)	(0.260)	(0.281)	(0.257)	(0.770)	(0.779)	(0.817)

Table 5-15. Coefficient in VAR Model with Export (2001.1~2006.7)

	NY Sectoral			NY Aggregate			US Sectoral			US Aggregate		
	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)	(-1)	(-2)	(-3)
1.Mining	-0.407	-0.195	-0.030	0.191	1.006	1.214	-0.194	0.321	0.099	-2.331	1.854	0.081
	(0.124)	(0.131)	(0.120)	(1.376)	(1.465)	(1.397)	(0.527)	(0.551)	(0.489)	(3.044)	(3.168)	(2.909)
2.Construction	-0.052	-0.017	-0.233	-0.089	0.250	-0.005	0.337	0.457	-0.306	-0.884	0.768	1.020
	(0.127)	(0.122)	(0.121)	0.356	(0.381)	(0.369)	(0.231)	(0.231)	(0.243)	(0.872)	(0.915)	(0.796)
3.Manufacturing	-0.081	-0.274	-0.192	0.202	0.175	0.561	0.095	0.694	0.233	0.014	0.259	-0.889
	(0.134)	(0.129)	(0.129)	(0.189)	(0.208)	(0.195)	(0.236)	(0.254)	(0.242)	(0.445)	(0.438)	(0.425)
4.Trade, transportation,	0.264	0.212	0.099	-0.372	0.048	-0.055	0.212	0.159	0.003	0.039	-0.199	0.384
utilities	(0.187)	(0.191)	(0.195)	(0.283)	(0.294)	(0.280)	(0.296)	(0.296)	(0.307)	(0.515)	(0.506)	(0.475)
5.Information	-0.320	-0.179	0.027	-0.093	0.965	1.736	0.494	0.664	0.032	0.006	-1.143	-0.013
	(0.117)	(0.127)	(0.124)	(0.523)	(0.575)	(0.552)	(0.362)	(0.344)	(0.354)	(1.358)	(1.310)	(1.127)
6.Finance	0.003	-0.092	-0.547	0.082	0.311	1.120	0.430	-0.923	1.009	1.431	-0.209	0.057
	(0.161)	(0.156)	(0.156)	(0.531)	(0.540)	(0.529)	(0.468)	(0.479)	(0.451)	(0.821)	(0.833)	(0.764)
7.Profession, business	-0.037	-0.152	-0.334	-0.413	0.089	0.777	0.508	0.734	0.081	0.327	-1.230	0.616
	(0.216)	(0.216)	(0.227)	(0.465)	(0.463)	(0.458)	(0.285)	(0.285)	(0.285)	(0.848)	(0.835)	(0.821)
8.Education, health	0.067	0.209	-0.316	-0.145	-0.153	0.522	0.468	0.008	0.269	-0.486	0.825	-0.609
	(0.105)	(0.089)	(0.094)	(0.110)	(0.116)	(0.118)	(0.172)	(0.196)	(0.192)	(0.270)	(0.284)	(0.235)
9.Leisure, hospitality	-0.043	-0.109	-0.232	-0.296	1.367	0.512	0.547	-0.050	-0.563	-1.713	-0.233	0.926
	(0.167)	(0.181)	(0.164)	(0.621)	(0.660)	(0.594)	(0.375)	(0.363)	(0.352)	(1.142)	(1.171)	(1.091)
10.Other services	-0.058	-0.111	-0.364	-0.283	0.317	0.426	0.175	0.238	-0.126	0.239	0.044	-0.322
	(0.140)	(0.149)	(0.144)	(0.208)	(0.245)	(0.232)	(0.242)	(0.251)	(0.232)	(0.399)	(0.427)	(0.348)
11.Government	-0.237	-0.150	-0.224	-0.299	-0.661	-0.235	-0.579	0.517	0.395	0.902	0.845	-0.906
	(0.124)	(0.126)	(0.127)	(0.281)	(0.285)	(0.259)	(0.316)	(0.339)	(0.336)	(0.597)	(0.631)	(0.539)

increasing from 4.3% to 14.6% and 18.7%, respectively. Similar to the baseline with time split model, the contribution of national aggregate shock conspicuously increases from 0.2% to 12%, implying that economic recession plays some important role on NY State employment in the government sector.

In education and health, both national sectoral shock and regional aggregate shock become more important after recession than before recession. Regional sectoral shock explains 81% of the variance in NY State employment in the education and health industry before recession, but explains only 59% of the variance after recession. In information and finance sectors, the influence of regional aggregate shock is conspicuously increased respectively, implying the declines in total employment in NY State after recession affected industrial employment in those sectors.

The impulse response functions before recession (1996 – 2000) are presented in Figure 5-18 to Figure 5-22. When state export is considered, it is interesting that, before recession, none of the shocks permanently affects NY state total employment. They just show short run disturbances, coming quickly back to the original state. However, the impulse response functions after recession (2001 – 2006) shows similar pattern to that of earlier models. Figure 5-23 to Figure 5-27 present impulse response functions after recession. The implications are similar to that of baseline model with time split and that of model with export. That is, only NY State aggregate shocks affect total NY State employment, and the role of export are not significant.

Table 5-16. Variance Decomposition for VAR Model with Export (1996.1-2000.12)

	Share of variance due to				
	US aggregate	US sectoral	NY aggregate	NY sectoral	NY export
Mining					
1month	0	0	0	1	0
12 month	0.041	0.033	0.011	0.874	0.041
36 month	0.041	0.033	0.011	0.874	0.041
60months	0.041	0.033	0.011	0.874	0.041
Construction					
1month	0	0	0	1	0
12 month	0.067	0.149	0.024	0.720	0.040
36 month	0.067	0.149	0.024	0.720	0.040
60months	0.067	0.149	0.024	0.720	0.040
Manufacturing					
1month	1	0	0	1	0
12 month	0.057	0.017	0.116	0.801	0.008
36 month	0.057	0.017	0.116	0.801	0.009
60months	0.057	0.017	0.116	0.801	0.009
Trade, transportation,					
1month	0	0	0	1	0
12 month	0.080	0.078	0.046	0.749	0.048
36 month	0.081	0.078	0.046	0.748	0.048
60months	0.081	0.078	0.046	0.748	0.048
Information					
1month	0	0	0	1	0
12 month	0.043	0.077	0.007	0.764	0.109
36 month	0.043	0.077	0.007	0.763	0.110
60months	0.043	0.077	0.007	0.763	0.110
Finance					
1month	0	0	0	1	0
12 month	0.025	0.017	0.028	0.918	0.012
36 month	0.025	0.018	0.028	0.917	0.012
60months	0.025	0.018	0.028	0.917	0.012
Professional, business					
1month	0	0	0	1	0
12 month	0.140	0.139	0.044	0.619	0.060
36 month	0.141	0.140	0.043	0.616	0.060
60months	0.141	0.140	0.043	0.616	0.060
Education, health					
1month	0	0	0	1	0
12 month	0.068	0.042	0.032	0.806	0.053
36 month	0.068	0.042	0.032	0.806	0.053
60months	0.068	0.042	0.032	0.806	0.053
Leisure, hospitality					
1month	0	0	0	1	0
12 month	0.038	0.042	0.051	0.855	0.014
36 month	0.038	0.043	0.051	0.855	0.014
60months	0.038	0.043	0.051	0.855	0.014
Other services					
1month	0	0	0	1	0
12 month	0.088	0.031	0.120	0.700	0.061
36 month	0.088	0.032	0.120	0.699	0.061
60months	0.088	0.032	0.120	0.699	0.061
Government					
1month	0	0	0	1	0
12 month	0.016	0.105	0.047	0.685	0.146
36 month	0.016	0.105	0.047	0.685	0.147
60months	0.016	0.105	0.047	0.685	0.147

Table 5-17. Variance Decomposition for VAR Model with Export (2001.1-2006.7)

	Share of variance due to				
	US Aggregate	US sectoral	NY Aggregate	NY sectoral	NY export
Mining					
1month	0	0	0	1	0
12 month	0.010	0.011	0.043	0.860	0.076
36 month	0.010	0.011	0.044	0.858	0.077
60 month	0.010	0.011	0.044	0.858	0.077
Construction					
1month	0	0	0	1	0
12 month	0.033	0.110	0.042	0.741	0.074
36 month	0.034	0.110	0.046	0.734	0.076
60 month	0.034	0.110	0.046	0.734	0.076
Manufacturing					
1month	0	0	0	1	0
12 month	0.053	0.371	0.106	0.422	0.048
36 month	0.057	0.418	0.103	0.379	0.044
60 month	0.057	0.420	0.103	0.377	0.043
Trade, transportation,					
1month	0	0	0	1	0
12 month	0.002	0.033	0.026	0.887	0.052
36 month	0.002	0.036	0.025	0.886	0.051
60 month	0.002	0.036	0.025	0.886	0.051
Information					
1month	0	0	0	1	0
12 month	0.031	0.070	0.138	0.697	0.063
36 month	0.034	0.072	0.142	0.687	0.064
60 month	0.034	0.072	0.142	0.687	0.064
Finance					
1month	0	0	0	1	0
12 month	0.029	0.052	0.146	0.614	0.160
36 month	0.030	0.052	0.148	0.610	0.160
60 month	0.030	0.052	0.148	0.610	0.160
Professional, business					
1month	0	0	0	1	0
12 month	0.016	0.115	0.034	0.763	0.071
36 month	0.017	0.117	0.033	0.761	0.071
60 month	0.017	0.117	0.033	0.761	0.071
Education, health					
1month	0	0	0	1	0
12 month	0.092	0.120	0.136	0.586	0.066
36 month	0.092	0.121	0.137	0.584	0.067
60 month	0.092	0.121	0.137	0.584	0.067
Leisure, hospitality					
1month	0	0	0	1	0
12 month	0.028	0.011	0.055	0.817	0.090
36 month	0.028	0.011	0.055	0.816	0.090
60 month	0.028	0.011	0.055	0.816	0.090
Other services					
1month	0	0	0	1	0
12 month	0.013	0.041	0.072	0.782	0.093
36 month	0.013	0.041	0.072	0.782	0.093
60 month	0.013	0.041	0.072	0.782	0.093
Government					
1month	0	0	0	1	0
12 month	0.123	0.084	0.038	0.568	0.187
36 month	0.123	0.085	0.038	0.566	0.187
60 month	0.123	0.085	0.038	0.566	0.187

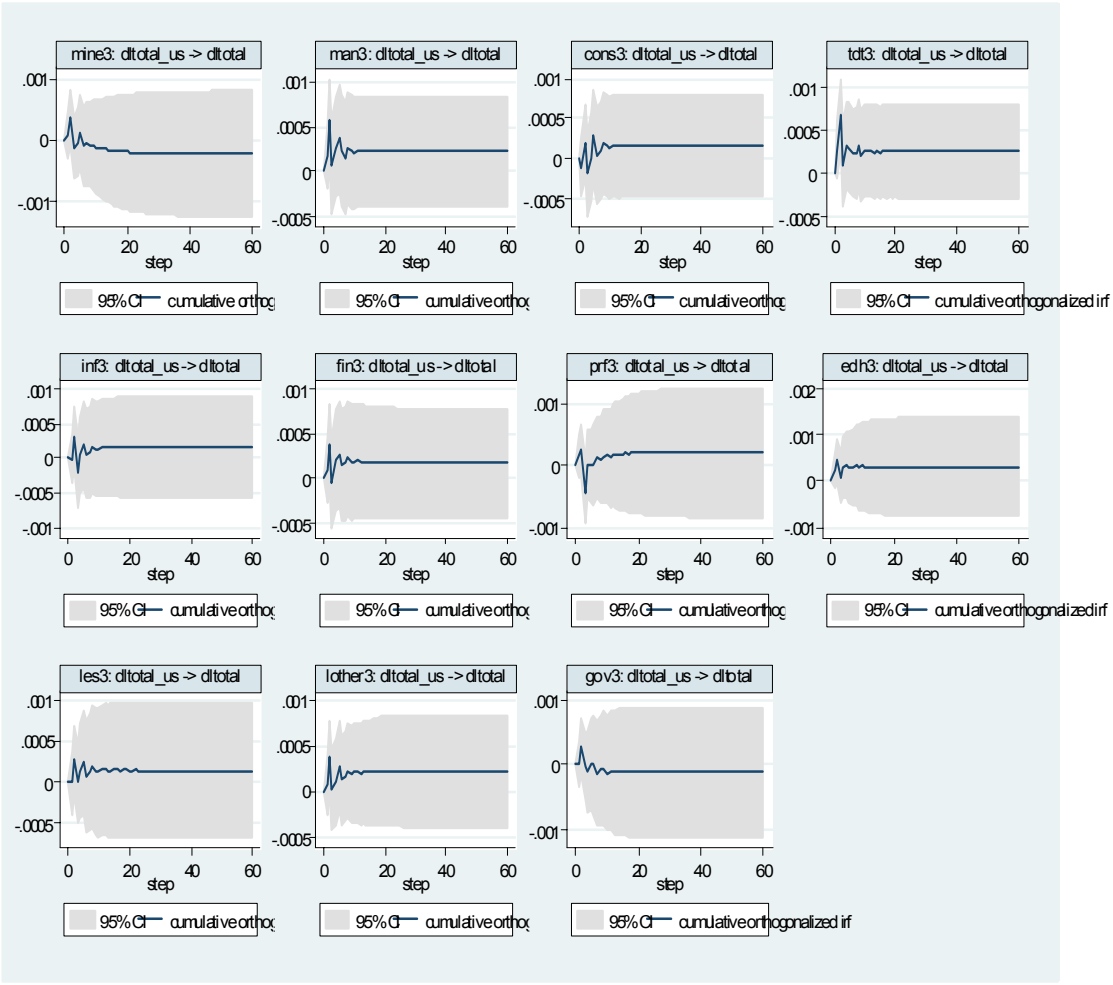


Figure 5-18. The Effect of US Aggregate Shocks on NYS Employment with State Export (1996.1-2000.12)

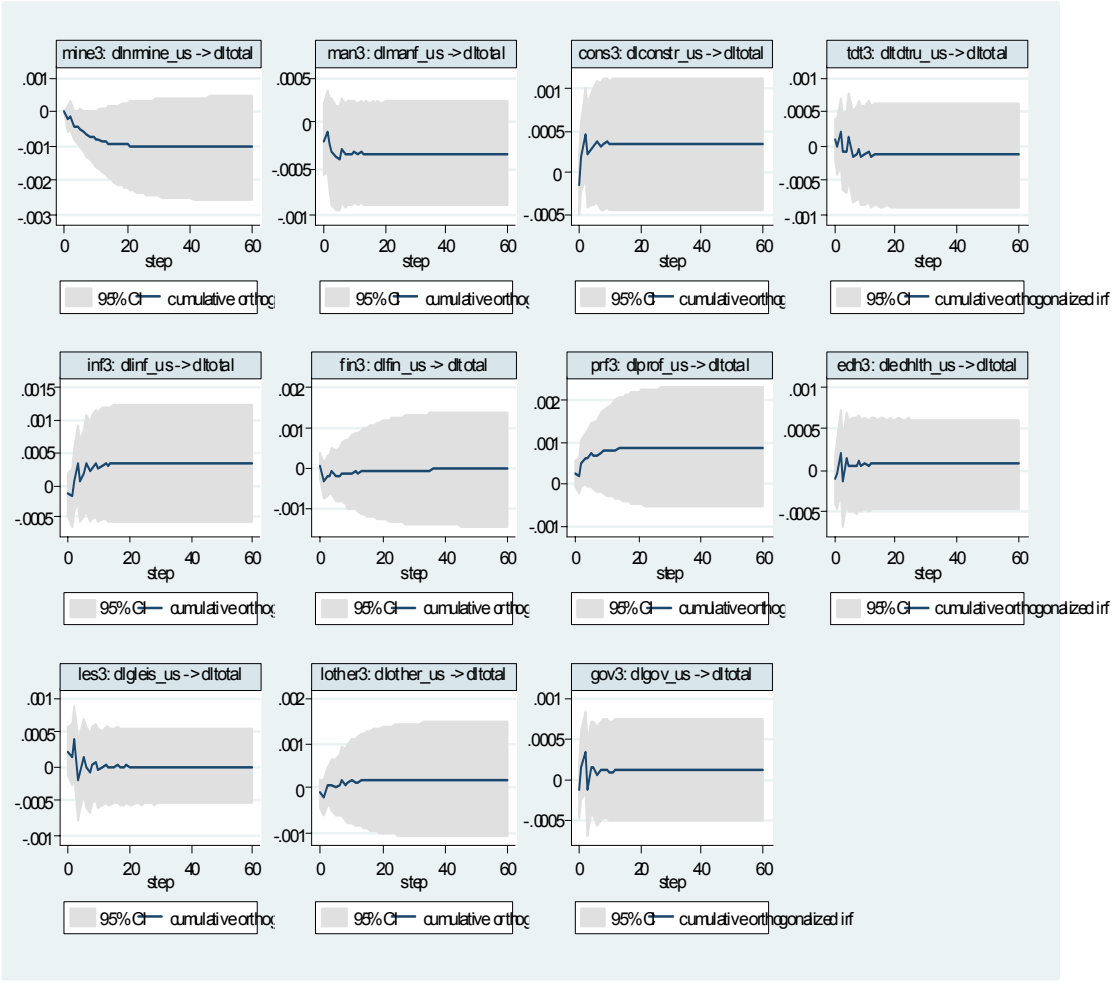


Figure 5-19. The Effect of US Sectoral Shocks on NYS Employment with State Export (1996.1-2000.12)

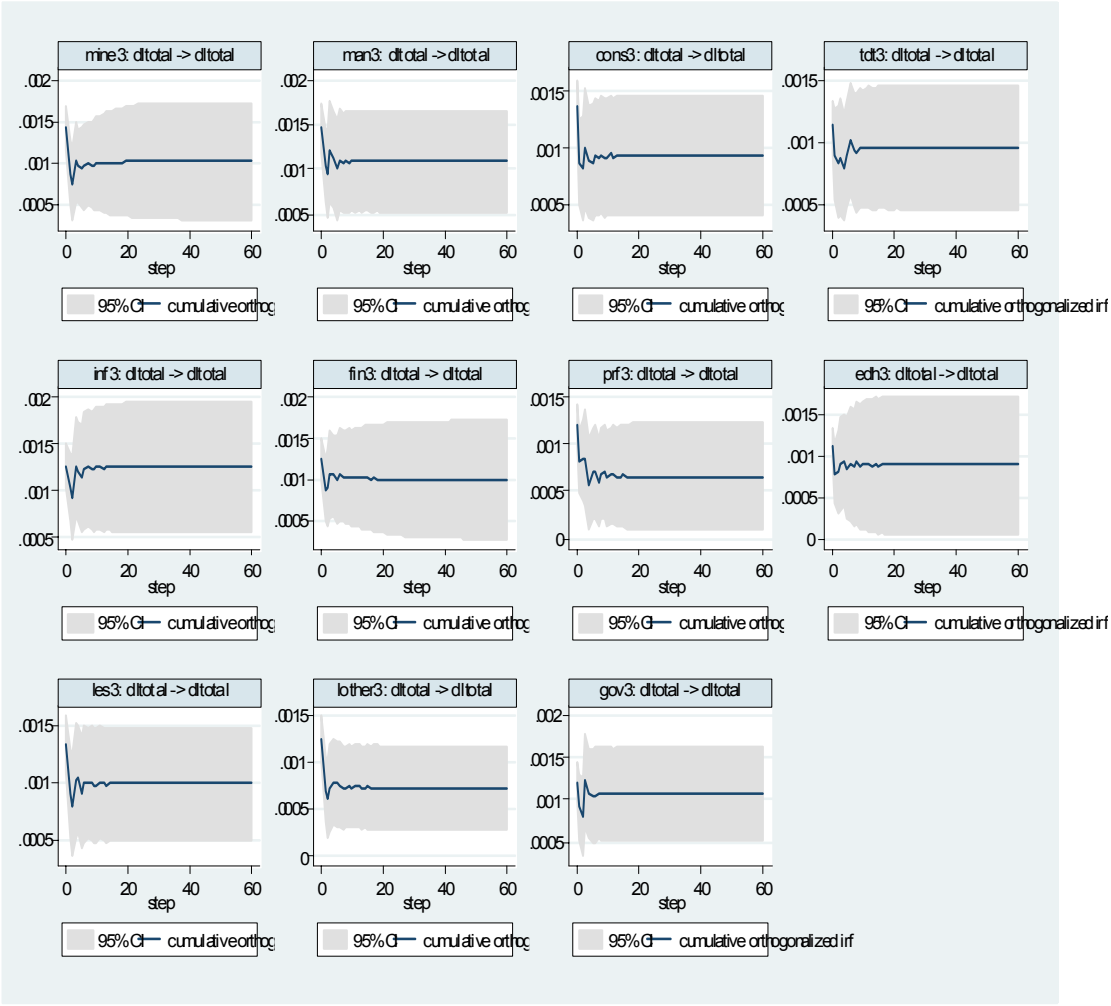


Figure 5-20. The Effect of NYS Aggregate Shocks on NYS Employment with State Export (1996.1-2000.12)

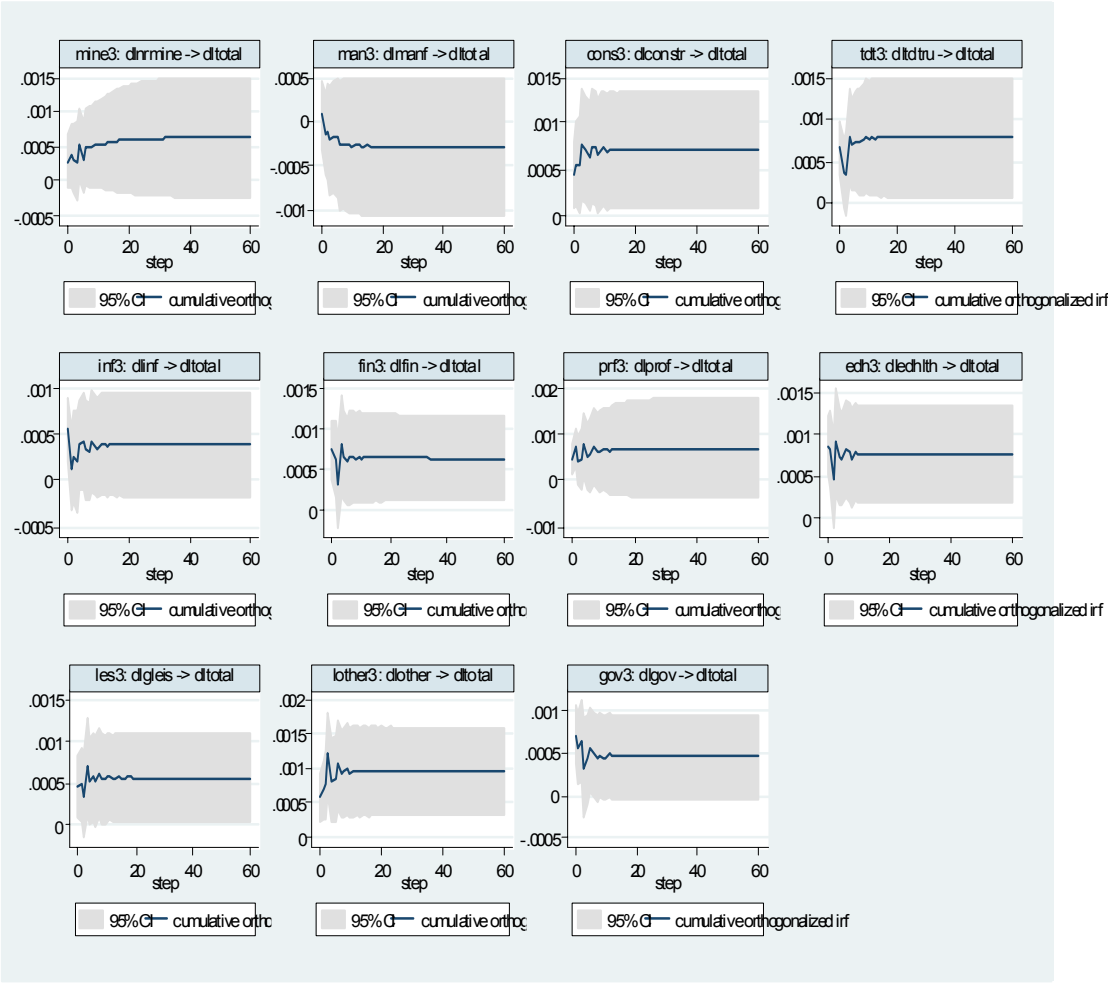


Figure 5-21. The Effect of NYS Sectoral Shocks on NYS Employment with State Export (1996.1-2000.12)

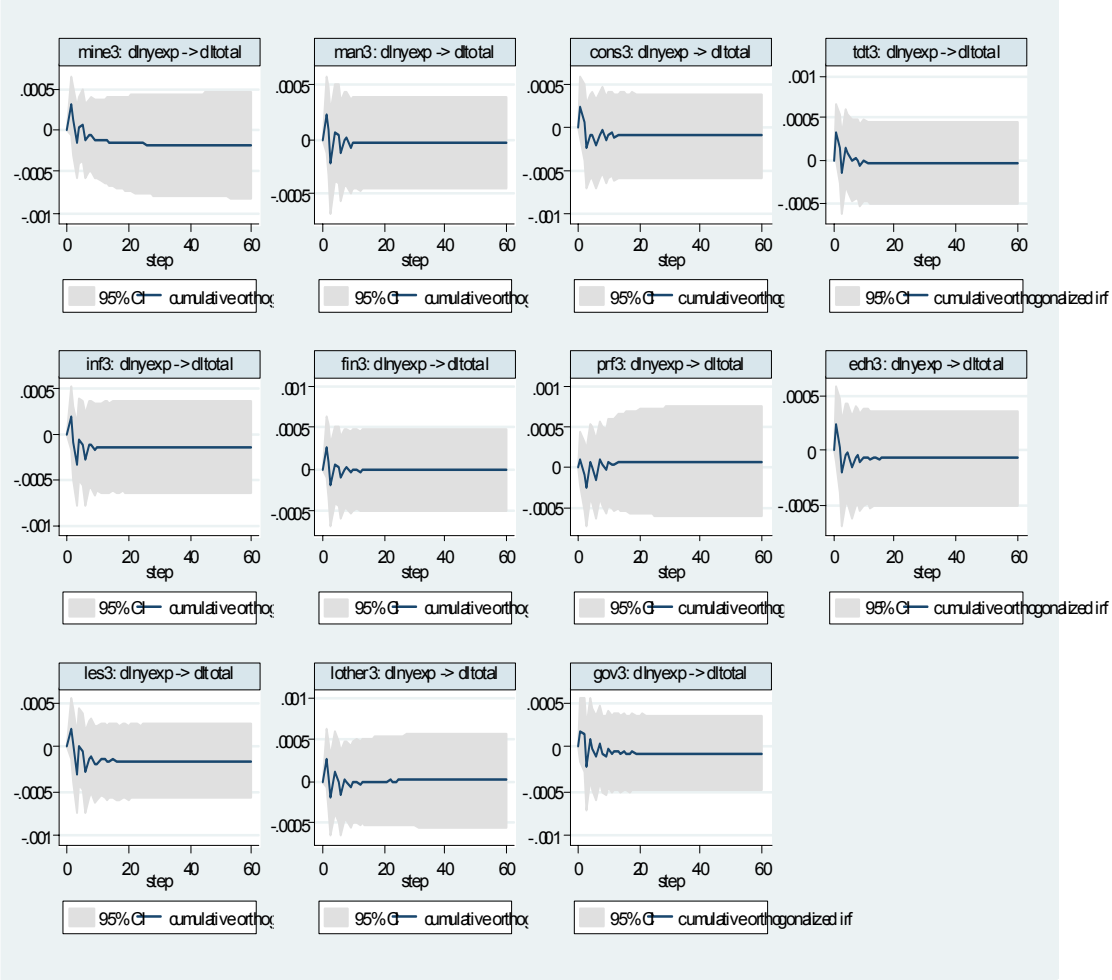


Figure 5-22. The Effect of Export Shocks on NYS Employment with State Export (1996.1-2000.12)

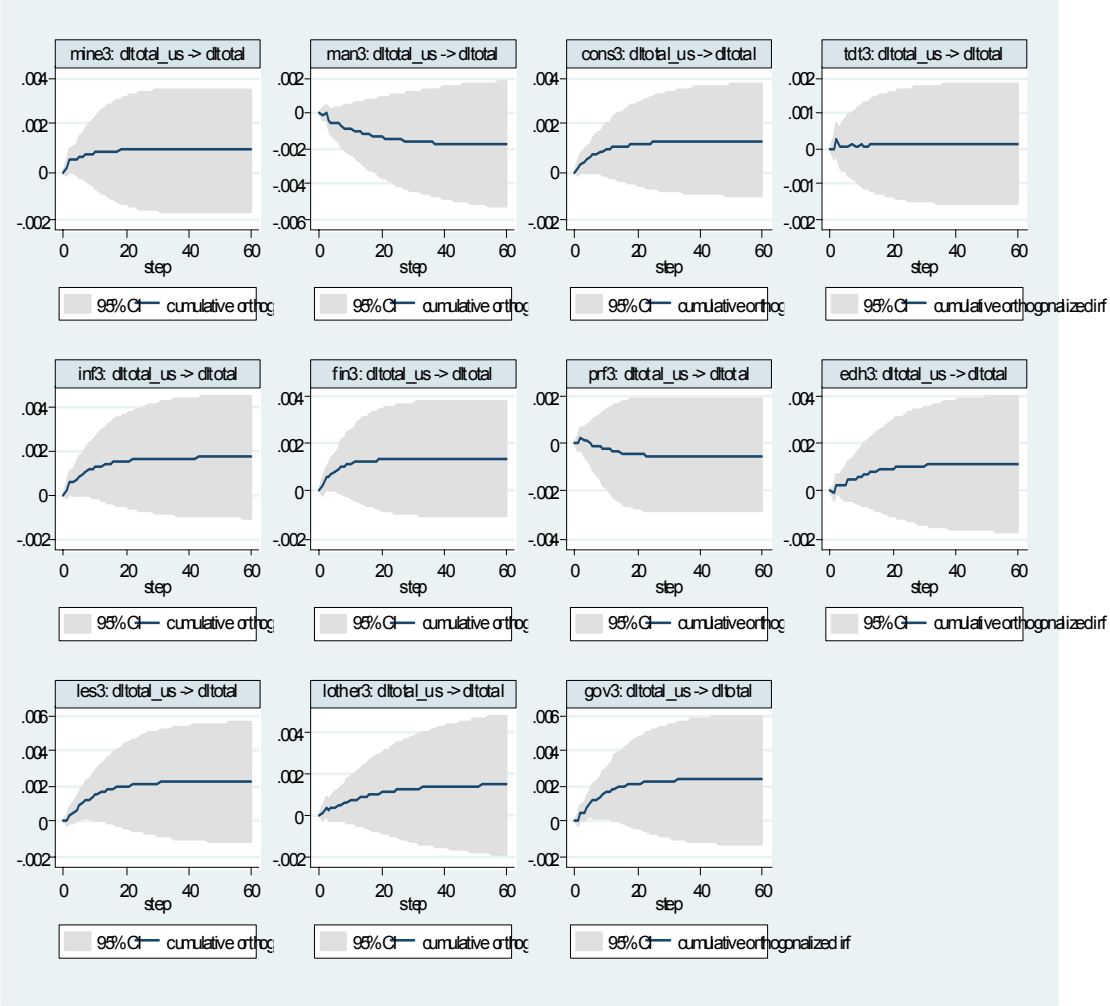


Figure 5-23. The Effect of US Aggregate Shocks on NYS Employment with State Export (2001.1-2006.7)

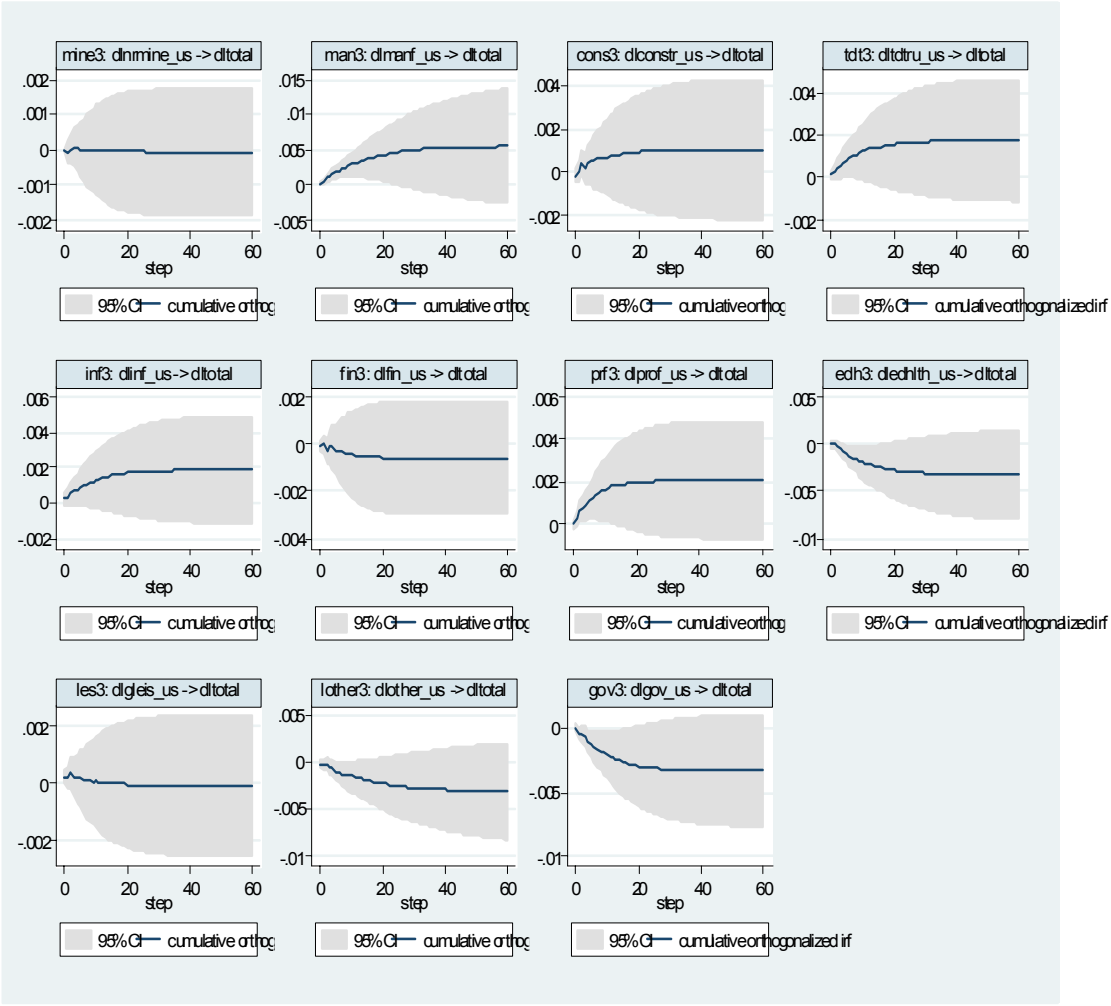


Figure 5-24. The Effect of US Sectoral Shocks on NYS Employment with State Export (2001.1-2006.7)

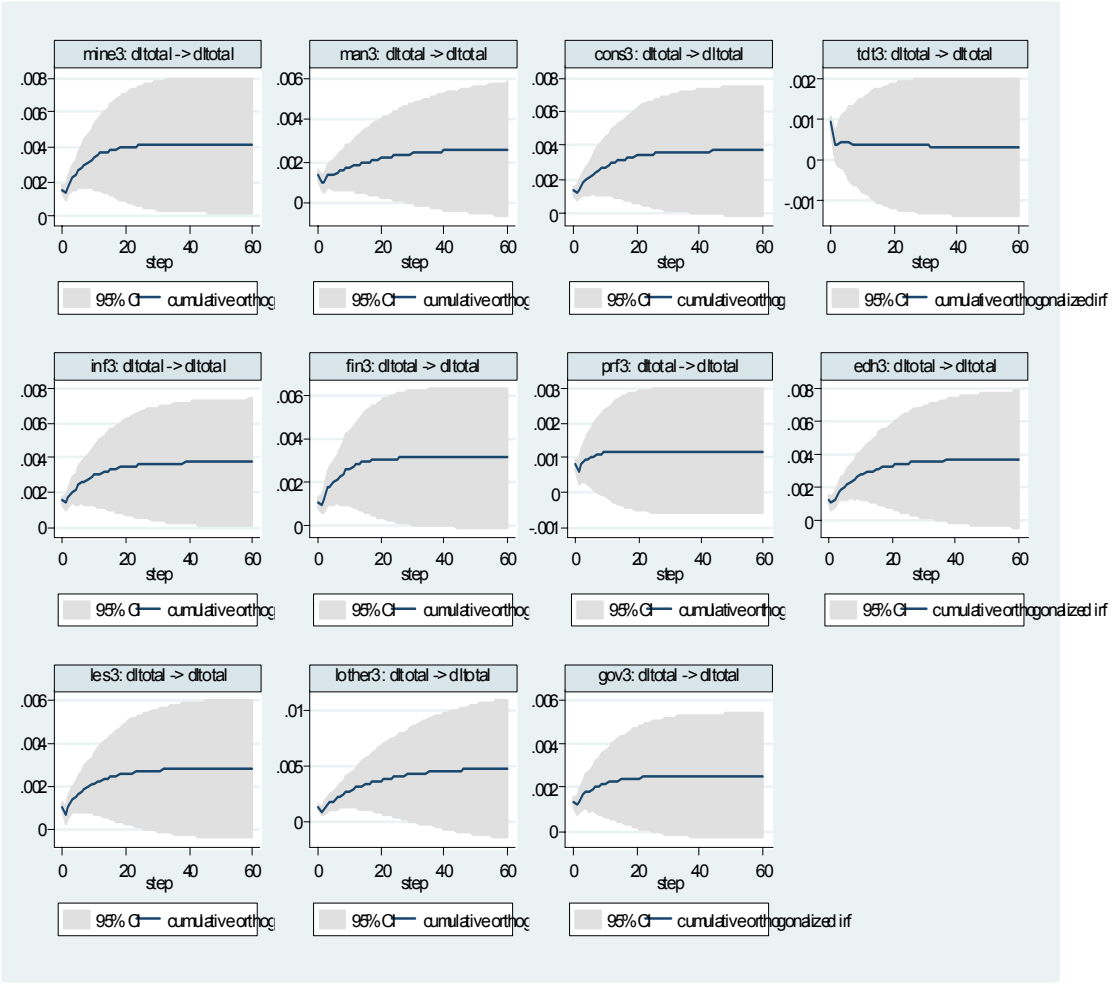


Figure 5-25. The Effect of NYS Aggregate Shocks on NYS Employment with State Export (2001.1-2006.7)

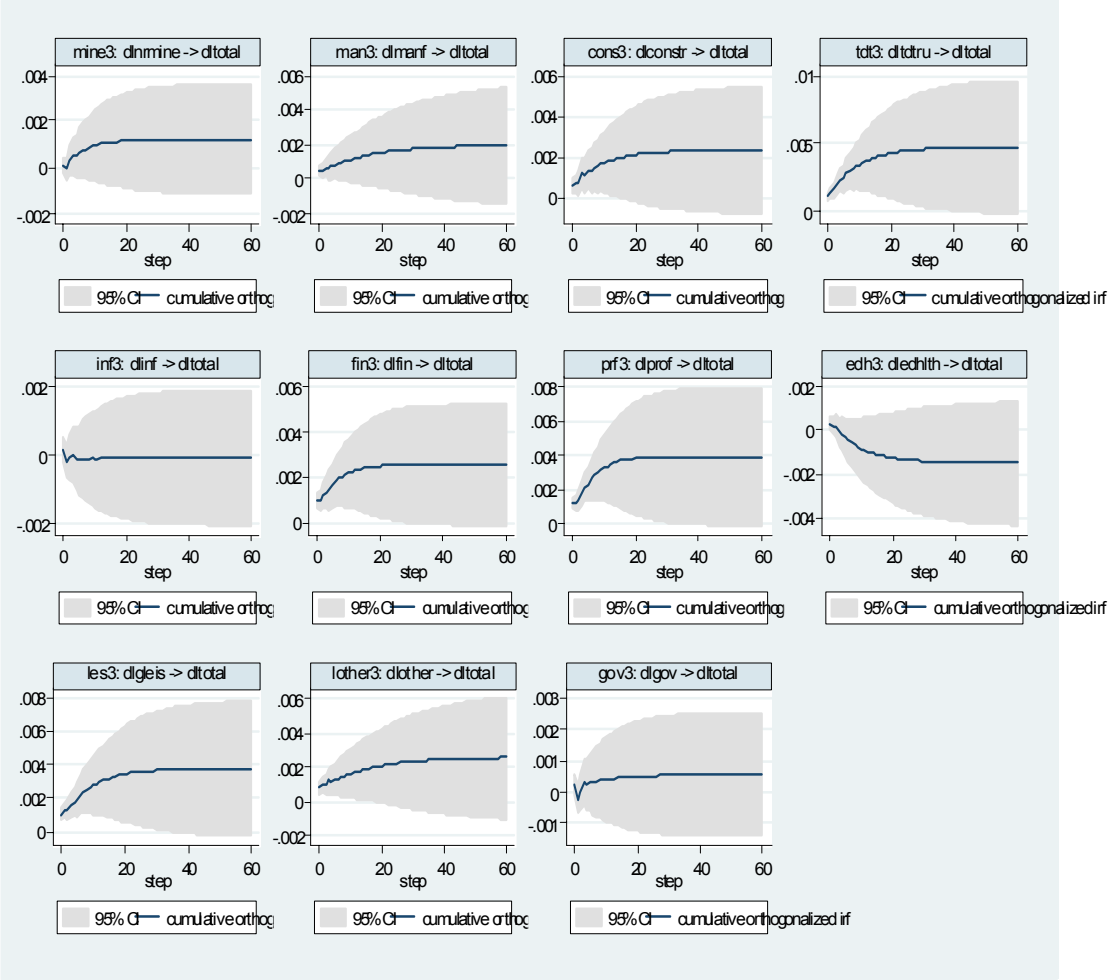


Figure 5-26. The Effect of NYS Sectoral Shocks on NYS Employment with State Export (2001.1-2006.7)

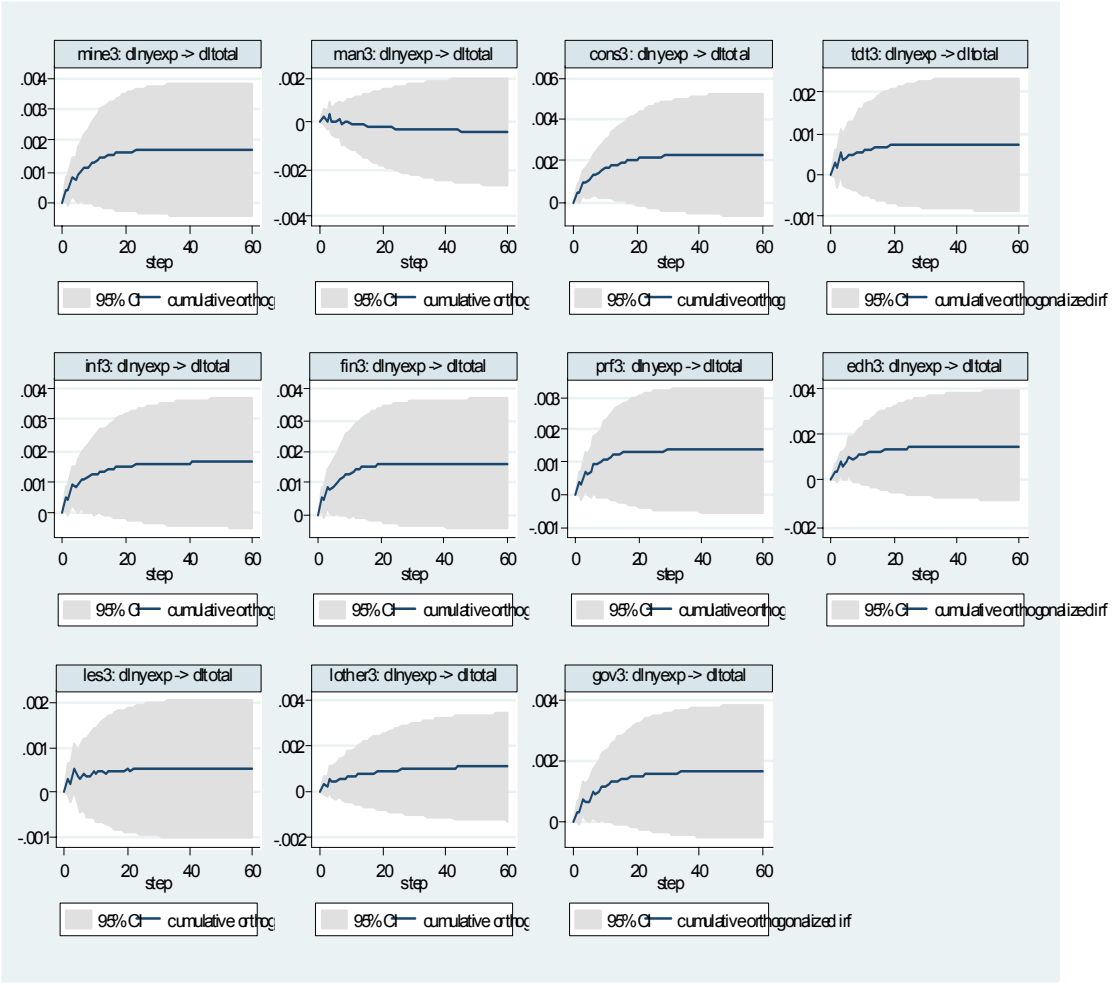


Figure 5-27. The Effect of Export Shocks on NYS Employment with State Export (2001.1-2006.7)

5.3.6. VAR Model with Cross-Industry Effect

Table 5-19 presents the coefficient from VAR model with cross-industry interaction. Variance decomposition is presented in Table 5-18. Consideration of cross-industry effect gives the same implication as the various models above. US aggregate shock explains only 8.4% to 9.7% of the total NY State employment fluctuation, while US sectoral sock explains over 90% of the employment fluctuation. Among industrial sectors, profession and business explains more than 10%, while other sectors explain about 1% of total employment fluctuations. The manufacturing sector contributes 1.4% in the short run, and 1.9% in the longer time period. Figure 28 shows the cumulative impulse response function, suggesting the same implication.

Table 5-18. Variance Decomposition for VAR Model with Cross-Industry Effect

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	US agg
NY total employment												
1month	0.039	0	0	0	0	0	0	0	0	0	0	0
12 month	0.032	0.020	0.014	0.005	0.014	0.010	0.109	0.042	0.013	0.016	0.052	0.084
36 month	0.034	0.018	0.019	0.004	0.014	0.009	0.110	0.050	0.014	0.023	0.085	0.097
60 month	0.034	0.018	0.019	0.004	0.014	0.009	0.110	0.050	0.014	0.023	0.090	0.097

* US agg: US total Employment, Mine: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government

Table 5-19. Coefficient in VAR Model with Cross-Industry Effect

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	NY agg	US agg
Ming													
(-1)	-0.384	-0.013	0.012	-0.002	-0.048	-0.001	-0.017	0.009	0.000	0.005	0.001	-0.003	.003
	(0.080)	(0.032)	(0.012)	(0.012)	(0.039)	(0.017)	(0.014)	(0.008)	(0.021)	(0.014)	(0.017)	(0.007)	0.004)
(-2)	-0.086	0.007	-0.004	-0.006	-0.069	0.027	0.008	-0.009	-0.031	-0.009	0.012	-0.003	0.004
	(0.084)	(0.033)	(0.013)	(0.013)	(0.041)	(0.018)	(0.015)	(0.008)	(0.022)	(0.015)	(0.018)	(0.008)	(0.004)
(-3)	-0.146	-0.092	-0.012	-0.002	-0.078	0.036	-0.027	-0.009	0.000	-0.016	-0.032	-0.016	-0.001
	(0.081)	(0.032)	(0.012)	(0.012)	(0.040)	(0.017)	(0.014)	(0.008)	(0.021)	(0.014)	(0.018)	(0.007)	(0.004)
Cons													
(-1)	1.108	0.177	0.066	0.009	0.269	-0.405	-0.077	0.016	0.041	-0.077	-0.194	-0.054	0.023
	(0.597)	(0.237)	(0.092)	(0.089)	(0.293)	(0.126)	(0.103)	(0.059)	(0.154)	(0.105)	(0.130)	(0.054)	(0.028)
(-2)	-0.962	-0.626	-0.131	-0.207	0.309	0.000	0.035	0.031	-0.173	-0.033	-0.118	-0.102	-0.020
	(0.591)	(0.235)	(0.091)	(0.088)	(0.289)	(0.124)	(0.102)	(0.058)	(0.152)	(0.103)	(0.128)	(0.053)	(0.028)
(-3)	-0.728	-0.401	0.062	0.091	0.221	0.183	0.185	0.052	-0.048	0.023	0.240	0.091	0.030
	(0.601)	(0.239)	(0.092)	(0.090)	(0.294)	(0.127)	(0.104)	(0.059)	(0.155)	(0.105)	(0.130)	(0.054)	(0.028)
Manf													
(-1)	1.721	-0.079	0.193	0.001	0.263	-1.034	-0.014	-0.108	0.014	-0.322	-0.972	-0.280	0.090
	(1.637)	(0.651)	(0.252)	(0.245)	(0.802)	(0.345)	(0.284)	(0.161)	(0.421)	(0.286)	(0.355)	(0.147)	(0.077)
(-2)	-2.256	-2.021	-0.311	-0.562	1.229	0.130	0.156	0.062	-0.425	-0.307	-0.648	-0.320	-0.031
	(1.616)	(0.642)	(0.249)	(0.242)	(0.791)	(0.340)	(0.280)	(0.159)	(0.416)	(0.283)	(0.351)	(0.145)	(0.076)
(-3)	-2.469	-1.349	0.312	0.143	0.736	0.299	0.158	0.097	-0.365	-0.003	0.525	0.124	0.050
	(1.650)	(0.656)	(0.254)	(0.247)	(0.808)	(0.347)	(0.286)	(0.163)	(0.425)	(0.289)	(0.358)	(0.148)	(0.078)
Trad													
(-1)	4.670	-0.388	0.525	-0.351	-0.040	-2.050	-0.325	-0.103	0.217	-0.622	-1.763	-0.597	0.065
	(3.058)	(1.216)	(0.471)	(0.458)	(1.498)	(0.644)	(0.530)	(0.301)	(0.787)	(0.535)	(0.664)	(0.275)	(0.144)
(-2)	-2.555	-3.768	-0.964	-1.249	1.592	-0.072	0.119	0.098	-0.891	-0.569	-0.981	-0.710	-0.128
	(3.004)	(1.194)	(0.462)	(0.450)	(1.471)	(0.633)	(0.520)	(0.296)	(0.774)	(0.526)	(0.652)	(0.270)	(0.142)
(-3)	-5.447	-3.218	0.215	0.104	1.945	0.656	0.256	0.076	-0.315	-0.170	1.239	0.218	0.041
	(3.075)	(1.222)	(0.473)	(0.461)	(1.506)	(0.648)	(0.533)	(0.303)	(0.792)	(0.538)	(0.667)	(0.276)	(0.145)
Inf													
(-1)	0.541	-0.001	0.079	-0.049	-0.402	-0.361	-0.082	0.022	-0.012	-0.139	-0.301	-0.117	0.021
	(0.544)	(0.216)	(0.084)	(0.081)	(0.266)	(0.115)	(0.094)	(0.054)	(0.140)	(0.095)	(0.118)	(0.049)	(0.026)
(-2)	-0.736	-0.645	-0.197	-0.242	0.041	0.044	-0.014	0.083	-0.204	-0.089	-0.204	-0.138	-0.022
	(0.539)	(0.214)	(0.083)	(0.081)	(0.264)	(0.114)	(0.093)	(0.053)	(0.139)	(0.094)	(0.117)	(0.048)	(0.025)
(-3)	-0.883	-0.412	0.034	0.031	0.257	0.110	0.009	0.029	-0.155	0.017	0.219	0.036	0.009
	(0.580)	(0.230)	(0.089)	(0.087)	(0.284)	(0.122)	(0.100)	(0.057)	(0.149)	(0.101)	(0.126)	(0.052)	(0.027)
Fin													
(-1)	1.436	-0.108	0.251	-1.197	0.215	-1.016	-0.204	0.009	0.053	-0.423	-0.758	-0.265	0.061
	(1.413)	(0.562)	(0.217)	(0.212)	(0.692)	0.298	(0.245)	(0.139)	(0.364)	(0.247)	(0.306)	(0.127)	(0.067)
(-2)	-2.177	-1.792	-0.394	-0.553	0.226	0.057	0.045	0.084	-0.425	-0.273	-0.360	-0.313	-0.055
	(1.379)	(0.548)	(0.212)	(0.207)	(0.675)	(0.290)	(0.239)	(0.136)	(0.355)	(0.241)	(0.299)	(0.124)	(0.065)
(-3)	-1.626	-1.272	0.140	0.039	0.827	0.157	-0.090	0.113	-0.431	-0.236	0.338	0.018	0.013
	(1.455)	(0.578)	(0.224)	(0.218)	(0.712)	(0.306)	(0.252)	(0.143)	(0.375)	(0.255)	(0.316)	(0.131)	(0.069)
Prof													
(-1)	2.486	0.348	0.293	-0.049	0.383	-1.138	-0.058	0.005	0.051	-0.193	-0.656	-0.192	0.126
	(1.825)	(0.725)	(0.281)	(0.273)	(0.893)	(0.384)	(0.316)	(0.180)	(0.470)	(0.319)	(0.396)	(0.164)	(0.086)
(-2)	-1.826	-2.463	-0.487	-0.761	1.147	0.048	0.149	0.074	-0.675	-0.368	-0.552	-0.407	-0.067
	(1.777)	(0.706)	(0.273)	(0.266)	(0.870)	(0.374)	(0.308)	(0.175)	(0.458)	(0.311)	(0.385)	(0.160)	(0.084)
(-3)	-3.111	-1.261	0.220	0.232	0.797	0.346	0.352	0.108	-0.002	0.279	1.060	-0.298	0.065
	(1.849)	(0.735)	(0.285)	(0.277)	(0.906)	(0.390)	(0.320)	(0.182)	(0.476)	(0.324)	(0.401)	(0.166)	(0.087)

Table 5-19. (continued)

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	NY agg	US agg
Educ													
(-1)	1.972	-0.299	0.388	-0.292	0.039	-2.003	-0.285	-0.066	-0.013	-0.714	-1.109	-0.492	0.082
	(2.566)	(1.020)	(0.395)	(0.384)	(1.256)	(0.540)	(0.444)	(0.253)	(0.661)	(0.449)	(0.557)	(0.231)	(0.121)
(-2)	-2.011	-3.686	-0.875	-1.201	0.748	-0.001	-0.185	0.184	-0.997	-0.534	-1.134	-0.759	-0.189
	(2.493)	(0.991)	(0.384)	(0.373)	(1.221)	(0.525)	(0.432)	(0.246)	(0.642)	(0.436)	(0.541)	(0.224)	(0.118)
(-3)	-3.770	-1.698	0.112	0.164	1.034	0.452	-0.095	0.015	-0.629	0.242	1.192	0.171	0.051
	(2.647)	(1.053)	(0.407)	(0.397)	(1.296)	(0.558)	(0.459)	(0.261)	(0.682)	(0.463)	(0.574)	(0.238)	(0.125)
Leis													
(-1)	0.670	-0.357	0.250	-0.046	-0.223	-0.689	-0.091	0.007	-0.208	-0.248	-0.552	-0.207	0.031
	(1.170)	(0.465)	(0.180)	(0.175)	(0.573)	(0.246)	(0.203)	(0.115)	(0.301)	(0.205)	(0.254)	(0.105)	(0.055)
(-2)	-1.387	-1.339	-0.369	-0.556	0.522	0.030	-0.031	0.126	-0.532	-0.148	-0.275	-0.272	-0.064
	(1.175)	(0.467)	(0.181)	(0.176)	(0.575)	(0.247)	(0.203)	(0.116)	(0.302)	(0.206)	(0.255)	(0.106)	(0.055)
(-3)	-2.039	-0.679	0.196	0.136	0.617	0.163	0.106	0.048	-0.256	0.155	0.502	0.130	0.050
	(1.261)	(0.501)	(0.194)	(0.189)	(0.618)	(0.266)	(0.218)	(0.124)	(0.325)	(0.221)	(0.274)	(0.113)	(0.060)
Oth													
(-1)	0.075	-0.022	0.135	-0.117	-0.153	-0.339	-0.042	0.013	0.073	-0.154	-0.405	-0.127	0.017
	(0.749)	(0.298)	(0.115)	(0.112)	(0.367)	(0.158)	(0.130)	(0.074)	(0.193)	(0.131)	(0.162)	(0.067)	(0.035)
(-2)	-0.216	-0.503	-0.094	-0.199	0.575	-0.025	-0.001	0.169	-0.102	-0.174	-0.135	-0.073	-0.028
	(0.707)	(0.281)	(0.109)	(0.106)	(0.346)	(0.149)	(0.122)	(0.070)	(0.182)	(0.124)	(0.153)	(0.064)	(0.033)
(-3)	-1.508	-0.417	-0.112	0.127	0.108	0.206	-0.058	-0.007	-0.167	-0.092	0.352	0.045	-0.027
	(0.733)	(0.291)	(0.113)	(0.110)	(0.359)	(0.154)	(0.127)	(0.072)	(0.189)	(0.128)	(0.159)	(0.066)	(0.035)
Gov													
(-1)	3.524	-0.146	0.408	-0.186	-0.009	-2.076	-0.347	0.018	0.084	-0.583	-1.611	-0.541	0.090
	(2.797)	(1.112)	(0.430)	(0.419)	(1.370)	(0.589)	(0.485)	(0.276)	(0.720)	(0.490)	(0.607)	(0.252)	(0.132)
(-2)	-3.136	-3.256	-0.807	-1.158	1.928	0.094	0.118	0.187	-0.834	-0.474	-0.950	-0.607	-0.102
	(2.747)	(1.092)	(0.423)	(0.411)	(1.345)	(0.579)	(0.476)	(0.271)	(0.707)	(0.481)	(0.596)	(0.247)	(0.130)
(-3)	-4.797	-2.390	0.304	0.333	0.949	0.664	0.266	0.091	-0.383	0.108	0.880	0.215	0.060
	(2.863)	(1.138)	(0.441)	(0.429)	(1.402)	(0.603)	(0.496)	(0.282)	(0.737)	(0.501)	(0.621)	(0.257)	(0.135)
NY agg													
(-1)	-17.986 (15.463)	0.335 (6.148)	-2.696 (2.379)	0.961 (2.316)	-0.304 (7.572)	10.725 (3.257)	1.434 (2.679)	-0.149 (1.524)	-0.687 (3.981)	2.934 (2.706)	7.874 (3.355)	2.572 (1.390)	-0.563 (0.730)
(-2)	18.139 (15.125)	18.702 (6.013)	4.402 (2.327)	6.517 (2.265)	-7.844 (7.407)	-0.556 (3.186)	-0.523 (2.620)	-1.293 (1.490)	5.408 (3.894)	2.575 (2.647)	4.338 (3.281)	3.360 (1.360)	0.634 (0.714)
(-3)	27.118 (15.889)	13.522 (6.317)	-1.365 (2.445)	-1.102 (2.380)	-6.264 (7.781)	-3.360 (3.347)	-0.909 (2.753)	-0.553 (1.566)	2.884 (4.091)	0.227 (2.781)	-6.509 (3.447)	-1.177 (1.429)	-0.303 (0.750)
US agg													
(-1)	-2.272	-0.078	0.730	0.197	-1.154	0.605	-0.085	0.241	0.351	0.197	0.286	0.224	0.195
	(1.732)	(0.688)	(0.266)	(0.259)	(0.848)	(0.365)	(0.300)	(0.171)	(0.446)	(0.303)	(0.376)	(0.156)	(0.082)
(-2)	1.765	3.299	0.225	0.462	1.377	0.433	0.888	0.275	0.188	0.836	0.870	0.654	0.288
	(1.736)	(0.690)	(0.267)	(0.260)	(0.850)	(0.366)	(0.301)	(0.171)	(0.447)	(0.304)	(0.377)	(0.156)	(0.082)
(-3)	0.166	0.336	0.265	-0.054	-0.925	0.014	-0.100	-0.306	0.036	-0.299	-0.331	-0.120	0.065
	(1.810)	(0.720)	(0.279)	(0.271)	(0.886)	(0.381)	(0.314)	(0.178)	(0.466)	(0.317)	(0.393)	(0.163)	(0.085)

* US agg: US total employment, Mine: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government, NY agg; NY total employment

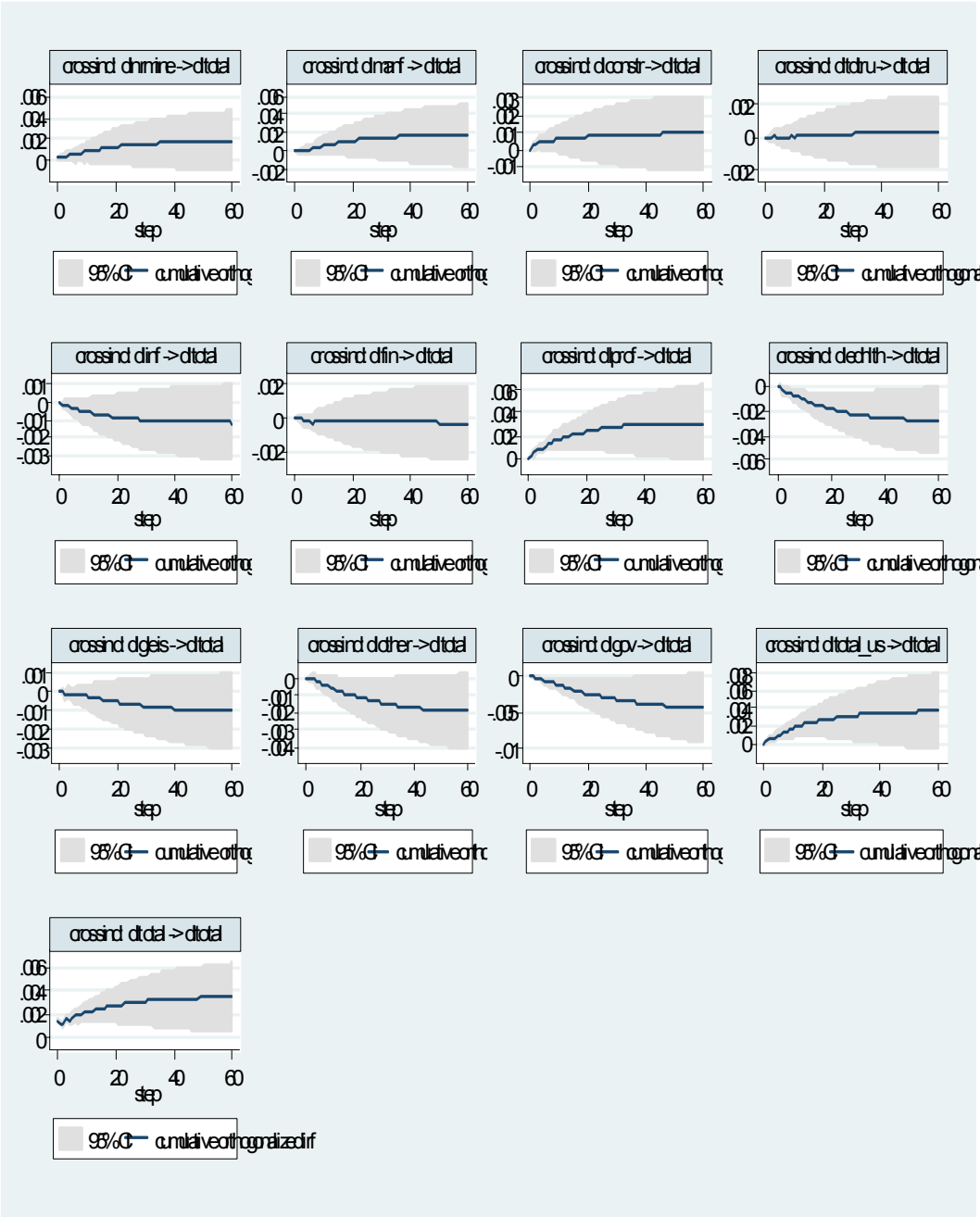


Figure 5-28. The Effect of NYS Sectoral, US Aggregate, and NYS Aggregate Shocks on NYS Employment with Cross-Industry Effect

5.3.7. VAR Model with Cross-Industry Effect and NYS Export

When NY State export is added to the above model, the result is similar. Table 5-20 presents coefficient for VAR model, and Table 5-21 shows variance decomposition. US aggregate shock contributes only 9.1% to 11.6% of the NY State total employment fluctuations. NY State export explains another 4.5% of the fluctuations, and NY sectoral shocks explain about 85% of the employment fluctuations. The cumulative impulse response function in Figure 29 provides the similar information. Among sectors, profession and business, and education and health contribute about 7% and 8%, respectively. The manufacturing sector contributes only 0.5% of the NY State total employment fluctuations.

Table 5-20. Variance Decomposition for VAR Model with Cross-Industry Effect and Export

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	NY exp	US agg
NY total emp													
1month	0.037	0	0	0	0	0	0	0	0	0	0	0	0
12 month	0.034	0.055	0.005	0.014	0.028	0.014	0.062	0.068	0.020	0.016	0.008	0.045	0.091
36 month	0.035	0.055	0.005	0.013	0.033	0.015	0.073	0.081	0.019	0.015	0.009	0.041	0.114
60 month	0.035	0.055	0.005	0.013	0.034	0.015	0.074	0.082	0.019	0.015	0.009	0.041	0.116

* Ming: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government, NY exp; NY export, US agg: US total Employment,

Table 5-21. Coefficient in VAR Model with Cross-Industry Effect and Export

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	NY agg	US agg	NY exp
Ming														
(-1)	0.388	-0.020	0.010	0.003	-0.069	0.015	-0.015	-0.005	0.002	0.007	0.002	-0.003	-0.006	-1.117
	(0.100)	(0.034)	(0.015)	(0.015)	(0.059)	(0.023)	(0.016)	(0.010)	(0.026)	(0.017)	(0.021)	(0.009)	(0.004)	(0.607)
(-2)	-0.091	0.042	-0.004	-0.008	-0.022	0.034	0.000	-0.017	-0.031	-0.009	0.017	0.000	-2.624	-1.082
	(0.101)	(0.034)	(0.016)	(0.015)	(0.060)	(0.023)	(0.016)	(0.010)	(0.027)	(0.018)	(0.021)	(0.009)	(1.424)	(0.615)
(-3)	-0.958	0.008	-0.003	0.025	-0.095	0.047	-0.006	-0.010	-0.006	0.020	-0.064	-0.007	-0.002	0.248
	(0.099)	(0.034)	(0.015)	(0.015)	(0.059)	(0.023)	(0.016)	(0.010)	(0.026)	(0.017)	(0.021)	(0.009)	(0.004)	(0.605)
Cons														
(-1)	2.071	0.266	-0.109	-0.095	1.394	-0.348	0.197	0.065	-0.458	-0.010	0.338	0.063	0.106	1.294
	(1.200)	(0.408)	(0.185)	(1.176)	(0.710)	(0.276)	(0.196)	(0.125)	(0.319)	(0.208)	(0.251)	(0.112)	(0.053)	(7.318)
(-2)	-1.286	0.248	0.099	-0.170	0.598	0.049	-0.089	-0.156	-0.690	0.409	-0.312	-0.024	0.089	5.917
	(1.138)	(0.387)	(0.176)	(0.167)	(0.674)	(0.262)	(0.186)	(0.118)	(0.303)	(0.198)	(0.238)	(0.107)	(0.050)	(6.944)
(-3)	-1.996	-0.591	0.100	0.137	-0.179	-0.347	0.167	0.167	0.102	0.062	0.047	0.032	-0.069	-11.139
	(1.190)	(0.404)	(0.184)	(0.174)	(0.704)	(0.274)	(0.195)	(0.124)	(0.316)	(0.207)	(0.249)	(0.111)	(0.052	(7.260)
Manf														
(-1)	4.632	-0.729	-0.247	0.046	2.185	-0.828	0.643	-0.038	-0.953	-0.203	0.358	0.065	0.261	9.744
	(2.889)	(0.982)	(0.446)	(0.423)	(1.710)	(0.665)	(0.473)	(0.300)	(0.768)	(0.502)	(0.604)	(0.270)	(0.127)	(17.628)
(-2)	-2.946	-0.630	0.106	-0.536	1.576	0.266	-0.336	-0.290	1.581	0.559	-0.701	-0.088	0.203	15.638
	(2.813)	(0.956)	(0.435)	(0.412)	(1.665)	(0.648)	(0.460)	(0.292)	(0.748)	(0.489)	(0.588)	(0.263)	(0.123)	(17.166)
(-3)	-4.858	-1.376	0.233	0.278	-1.155	-0.993	-0.120	0.390	-0.146	-0.021	0.212	-0.051	-0.240	-18.892
	(2.876)	(0.978)	(0.445)	(0.421)	(0.704)	(0.662)	(0.471)	(0.299)	(0.765)	(0.500)	(0.601)	(0.269)	(0.126)	(17.553)
Trad														
(-1)	9.497	1.701	-0.523	-0.546	4.258	-1.694	1.234	0.044	-2.130	-0.226	0.872	0.083	0.407	23.778
	(6.045)	(2.055)	(0.934)	(0.885)	(3.579)	(1.392)	(0.989)	(0.628)	(1.607)	(1.051)	(1.263)	(0.566)	(0.265)	(36.889)
(-2)	-2.033	1.701	-0.433	-1.259	2.848	0.173	-0.745	-0.720	2.982	1.420	-1.170	-0.294	0.300	3.069
	(5.795)	(1.970)	(0.896)	(0.848)	(3.431)	(1.334)	(0.949)	(0.602)	(1.541)	(1.007)	(1.211)	(0.543)	(0.254)	(35.361)
(-3)	-10.729	-2.812	0.131	0.677	-0.215	-2.221	0.021	0.676	0.200	0.224	0.592	0.033	-0.478	-45.191
	(5.886)	(2.001)	(0.910)	(0.861)	(3.485)	(1.355)	(0.963)	(0.611)	(1.566)	(1.023)	(1.230)	(0.551)	(0.258)	(35.918)
Inf														
(-1)	1.670	0.326	-0.114	-0.077	0.478	-0.268	0.208	0.053	-0.467	-0.066	0.223	0.019	0.096	3.231
	(1.167)	(0.397)	(0.180)	(0.171)	(0.691)	(0.269)	(0.191)	(0.121)	(0.310)	(0.203)	(0.244)	(0.109)	(0.051)	(7.120)
(-2)	-0.837	0.337	-0.062	-0.247	0.156	0.036	-0.208	-0.041	-0.601	-0.286	-0.247	-0.061	(0.048)	0.119
	(1.097)	(0.373)	(0.170)	(0.160)	(0.649)	(0.253)	(0.180)	(0.114)	(0.291)	(0.191)	(0.229)	(0.103)		(6.694)
(-3)	-2.245	-0.457	-0.016	0.105	-0.315	-0.500	-0.517	0.134	-0.013	0.074	0.026	0.040	-0.108	-9.056
	(1.165)	(0.396)	(0.180)	(0.170)	(0.689)	(0.268)	(0.191)	(0.121)	(0.310)	(0.202)	(0.243)	(0.109)	(0.051)	(7.107)
Fin														
(-1)	4.001	0.670	-0.140	-0.191	2.192	-0.803	0.423	0.036	-0.949	-0.232	0.469	0.050	0.243	10.191
	(1.167)	(0.954)	(0.434)	(0.411)	(1.662)	0.647	(0.460)	(0.292)	(0.746)	(0.488)	(0.587)	(0.263)	(0.123)	(17.133)
(-2)	-2.342	-0.520	-0.024	-0.586	0.419	0.010	0.445	-0.202	1.503	0.616	-0.416	-0.123	0.126	4.677
	(2.660)	(0.904)	(0.411)	(0.390)	(1.575)	(0.613)	(0.435)	(0.276)	(0.708)	(0.462)	(0.556)	(0.249)	(0.117)	(16.236)
(-3)	-4.397	-1.110	0.021	0.293	-0.403	-1.296	-0.174	0.305	-0.086	-0.025	-0.166	-0.138	-0.248	-21.428
	(2.707)	(0.920)	(0.418)	(0.396)	(1.603)	(0.623)	(0.443)	(0.281)	(0.720)	(0.471)	(0.566)	(0.253)	(0.119)	(16.519)
Prof														
(-1)	6.518	1.166	-0.300	-0.164	3.034	-0.912	0.916	0.092	-1.577	0.016	1.034	0.215	0.370	11.353
	(4.063)	(1.381)	(0.628)	(0.594)	(2.406)	(0.936)	(0.665)	(0.422)	(1.081)	(0.706)	(0.849)	(0.380)	(0.178)	(24.796)
(-2)	-2.320	1.183	0.050	-0.831	2.161	0.056	-0.523	-0.464	2.067	0.924	-0.840	-0.158	0.250	6.675
	(3.930)	(1.336)	(0.608)	(0.575)	(2.327)	(0.905)	(0.643)	(0.408)	(1.046)	(0.683)	(0.822)	(0.368)	(0.172)	(23.988)
(-3)	-7.137	-1.282	0.200	0.533	-1.605	-1.633	0.190	0.556	0.428	0.550	-0.012	0.007	-0.332	-19.628
	(4.013)	(1.364)	(0.620)	(0.587)	(2.376)	(0.924)	(0.657)	(0.417)	(1.067)	(0.698)	(0.839)	(0.376)	(0.176)	(24.487)
Edu														
(-1)	7.320	1.135	-0.360	-0.440	4.151	-1.402	1.122	0.162	-2.478	-0.338	1.508	1.192	0.435	12.407
	(5.371)	(1.826)	(0.830)	(0.786)	(3.180)	(1.237)	(0.879)	(0.558)	(1.429)	(0.934)	(1.123)	(0.503)	(0.235)	(32.778)
(-2)	-2.209	1.252	-0.215	-1.291	1.803	-0.071	-1.112	-0.408	2.516	1.394	-1.444	-0.401	0.141	5.521
	(5.159)	(1.754)	(0.797)	(0.755)	(3.054)	(1.188)	(0.844)	(0.536)	(1.372)	(0.897)	(1.078)	(0.483)	(0.226)	(31.484)
(-3)	-9.872	-2.186	-0.204	0.258	-1.310	-2.486	-0.607	0.347	-0.426	0.355	0.242	-0.343	-0.484	-46.230
	(5.336)	(1.814)	(0.825)	(0.781)	(3.160)	(1.229)	(0.874)	(0.554)	(1.419)	(0.928)	(1.115)	(0.500)	(0.234)	(32.565)

Table 5-21. (continued)

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	NY agg	US agg	NY exp
Leis														
(-1)	3.370	0.533	-0.083	-0.112	1.504	-0.375	0.495	0.063	-1.184	0.078	0.478	0.081	0.196	5.389
	(2.433)	(0.827)	(0.376)	(0.356)	(1.440)	(0.560)	(0.398)	(0.253)	(0.647)	(0.423)	(0.508)	(0.228)	(0.107)	(14.847)
(-2)	-1.702	0.610	0.089	-0.541	0.874	0.051	-0.469	-0.168	1.107	0.700	-0.554	-0.132	0.102	-3.230
	(2.336)	(0.794)	(0.361)	(0.342)	(1.383)	(0.538)	(0.382)	(0.243)	(0.621)	(0.406)	(0.488)	(0.219)	(0.102)	(14.253)
(-3)	-4.689	-1.089	0.188	0.221	-0.682	-1.162	-0.026	0.264	-0.222	0.220	0.035	-0.086	-0.197	-16.160
	(2.523)	(0.858)	(0.390)	(0.369)	(1.494)	(0.581)	(0.413)	(0.262)	(0.671)	(0.439)	(0.527)	(0.236)	(0.107)	(15.397)
Oth														
(-1)	1.785	0.696	-0.020	-0.024	0.180	-0.033	0.315	0.076	-0.194	-0.042	0.171	0.091	0.117	7.573
	(1.477)	(.0502)	(0.228)	(0.216)	(0.874)	(0.340)	(0.242)	(0.153)	(0.393)	(0.257)	(0.309)	(0.138)	(0.065)	(9.013)
(-2)	-1.251	0.495	-0.070	-0.326	0.676	-0.050	-0.292	0.051	0.662	0.022	-0.039	-0.025	0.045	-0.052
	(1.310)	(0.445)	(0.202)	(0.192)	(0.776)	(0.302)	(0.214)	(0.136)	(0.349)	(0.228)	(0.274)	(0.123)	(0.057)	(7.996)
(-3)	-2.259	-0.064	-0.251	0.271	-0.818	0.362	0.014	0.033	0.013	0.065	0.083	-0.022	-0.193	-17.548
	(1.337)	(-0.455)	(0.207)	(0.196)	(0.792)	(0.308)	(0.219)	(0.139)	(0.356)	(0.232)	(0.280)	(0.125)	(0.059)	(8.161)
Gov														
(-1)	8.897	1.417	-0.406	-0.324	3.735	-1.624	0.967	0.124	-2.192	-0.205	0.929	0.090	0.454	19.613
	(5.622)	(1.911)	(0.869)	(0.823)	(3.328)	(1.295)	(0.920)	(0.584)	(1.495)	(0.977)	(1.175)	(0.526)	(0.246)	(34.307)
(-2)	-3.728	1.542	0.024	-1.137	2.985	0.134	-0.865	-0.511	2.993	1.279	-1.162	-0.207	0.319	8.829
	(5.368)	(1.825)	(0.830)	(0.786)	(3.178)	(1.236)	(0.879)	(0.557)	(1.428)	(0.933)	(1.220)	(0.503)	(0.235)	(32.758)
(-3)	-10.401	-2.528	0.331	0.728	-2.293	-2.100	0.089	0.579	0.321	0.389	-0.092	-0.104	-0.464	-41.947
	(5.548)	(1.886)	(0.857)	(0.812)	(3.285)	(1.278)	(0.908)	(0.576)	(1.476)	(0.964)	(1.160)	(0.519)	(0.243)	(33.858)
NY agg														
(-1)	-50.192	-8.986	2.223	1.911	-22.866	7.847	-6.519	-0.870	12.064	0.524	-6.527	-1.135	-2.624	-95.670
	(32.48)	(11.04)	(5.020)	(4.755)	(19.23)	(7.479)	(5.316)	(3.372)	(8.639)	(5.646)	(6.788)	(3.040)	(1.424)	(198.20)
(-2)	21.092	-8.981	0.285	7.140	-13.780	-0.490	4.598	2.802	-15.882	-7.757	5.824	1.387	-1.572	-33.746
	(30.91)	(10.51)	(4.77)	(4.525)	(18.30)	(7.118)	(5.060)	(3.210)	(8.222)	(5.373)	(6.460)	(2.894)	(1.355)	(188.63)
(-3)	59.342	13.360	-0.368	-3.235	9.898	13.174	0.353	-3.310	-0.020	-1.793	-0.760	0.882	2.922	248.701
	(31.94)	(10.86)	(4.937)	(4.677)	(18.91)	(7.356)	(5.229)	(3.317)	(8.497)	(5.552)	(6.677)	(2.991)	(1.400)	(194.94)
US agg														
(-1)	-0.979	-0.490	0.587	-0.090	-0.279	0.891	0.166	-0.089	-0.790	0.120	0.778	0.161	0.106	-6.824
	(2.240)	(0.762)	(0.346)	(0.328)	(1.326)	(0.516)	(0.367)	(0.233)	(0.596)	(0.389)	(0.468)	(0.210)	(0.098)	(13.671)
(-2)	0.519	2.141	0.385	0.070	1.523	0.586	0.584	0.375	-0.601	1.015	1.182	0.557	0.046	-39.766
	(2.136)	(0.726)	(0.330)	(0.313)	(1.264)	(0.492)	(0.350)	(0.221)	(0.568)	(0.371)	(0.446)	(0.200)	(0.094)	(13.033)
(-3)	1.130	0.419	0.015	-0.249	-1.187	-0.332	0.096	-0.636	-0.526	-0.230	-0.938	-0.413	-0.023	-11.084
	(2.232)	(0.759)	(0.345)	(0.327)	(1.322)	(0.514)	(0.365)	(0.232)	(0.534)	(0.388)	(0.467)	(0.209)	(0.098)	(13.623)
NY exp														
(-1)	-0.006	0.001	0.000	0.004	0.170	0.002	0.002	0.001	-0.001	0.005	0.003	0.003	0.002	-0.399
	(0.136)	(0.005)	(0.002)	(0.002)	(0.008)	(0.003)	(0.002)	(0.001)	(0.004)	(0.002)	(0.003)	(0.001)	(0.001)	(0.082)
(-2)	0.006	0.000	0.000	0.002	-0.001	0.000	-0.003	0.001	0.007	0.006	-0.005	0.000	0.001	-0.181
	(0.014)	(0.005)	(0.002)	(0.002)	(0.008)	(0.003)	(0.002)	(0.001)	(0.004)	(0.002)	(0.003)	(0.001)	(0.001)	(0.085)
(-3)	-0.020	-0.005	0.003	0.001	0.002	0.004	0.002	-0.002	0.004	-0.002	-0.008	-0.001	0.001	0.163
	(2.232)	(0.005)	(0.002)	(0.001)	(0.009)	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)	(0.001)	(0.001)	(0.045)

* Ming: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government, NY exp; NY export, US agg: US total Employment,

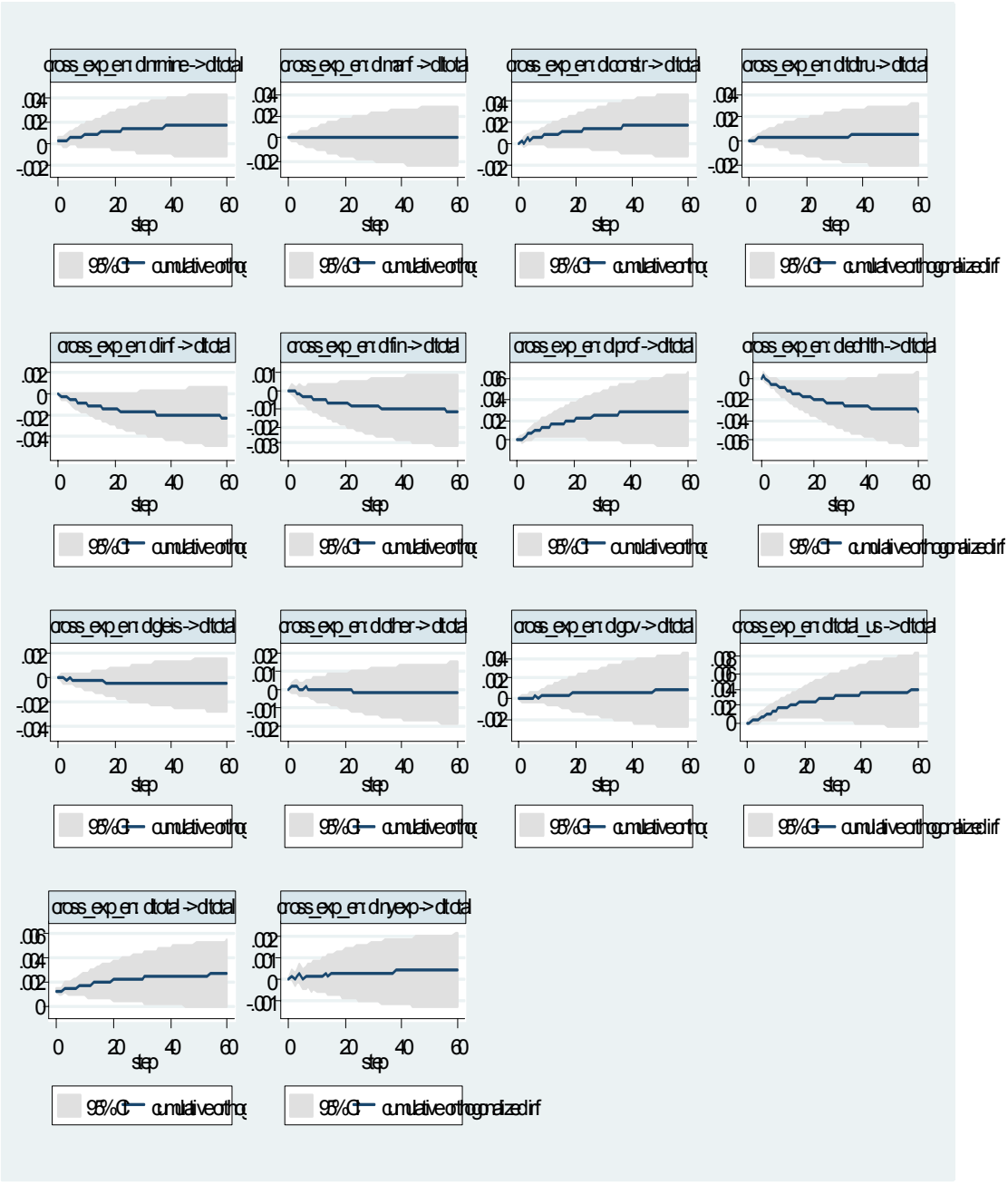


Figure 5-29. The Effect of US Aggregate Shocks on NYS Employment with Cross-Industry Effect and Export

5.3.8. SVAR Model with Cross-Industry Effect

Using input-output coefficient between industries, the SVAR model is estimated. The estimated correlations between industries are presented in Table 5-23. Table 5-22 gives variance decomposition with cross-industry effect. In SVAR model with non-identical cross-industry effect, the contribution of US aggregate shock is larger than the estimates from VAR model. However, the basic implication is similar. US aggregate shock explains only 9.1% to 11.6% of the NY State employment fluctuations, while NY State sectoral shocks contribute about 89% of the variance. The contribution of each industrial sector is somewhat different from the previous model. The role of mining, profession and business, leisure and hospitality, other services, and government sector is smaller than previous model. The contribution of the manufacturing sector is larger, explaining 3.1% – 3.3% of the variance.

Table 5-22. Variance decomposition for SVAR Model with Cross-Industry Effect

	Ming	Cons	Manf	Trad	Inf	Fin	Prof	Educ	Leis	Oth	Gov	US agg
NY total employment												
1 month	0	0	0	0	0	0	0	0	0	0	0	0
12 month	0.014	0.033	0.033	0.006	0.032	0.015	0.068	0.059	0.008	0.014	0.032	0.072
36 month	0.014	0.031	0.031	0.006	0.048	0.022	0.102	0.074	0.007	0.015	0.037	0.131

Table 5-23. Estimates on Variances

	Total	US agg	nrmi	Cons	Mnf	Trad	.Inf	.Fin	.Prof	Educ	Leis	Oth	Gov
Total	1	0	0	0	0	0	0	0	0	0	0	0	0
US agg	-0.596	1	0	0	0	0	0	0	0	0	0	0	0
Mine	0.949	0.155	1	0	0	0	0	0	0	0	0	0	0
Cons	0.773	0.881	0.098	1	0	0	0	0	0	0	0	0	0
Mnf	0.189	0.080	-0.004	-0.014	1	0	0	0	0	0	0	0	0
Trad	0.400	0.391	0.001	0.060	-0.141	1	0	0	0	0	0	0	0
Inf	0.533	0.317	0.028	-0.211	0.194	-0.797	1	0	0	0	0	0	0
Fin	0.535	0.446	-0.013	0.045	-0.120	0.545	0.005	1	0	0	0	0	0
Prof	0.378	0.266	0.023	-0.019	0.146	-0.437	-0.025	-0.020	1	0	0	0	0
Educ	0.170	0.172	-0.016	0.021	-0.201	0.575	-0.033	0.329	-0.495	1	0	0	0
Leis	0.459	0.342	-0.033	0.108	0.448	-0.523	-0.061	-0.218	0.843	-1.074	1	0	0
Oth	0.415	0.361	-0.051	0.201	-0.262	1.283	-0.014	0.593	-0.737	1.699	-0.179	1	0
Gov	0.208	0.070	0.062	0.166	0.270	-1.895	0.015	-1.119	1.184	-2.536	0.305	-1.129	1

* US agg: US total Employment, Mine: Mining, Cons: Construction, Mnf: Manufacturing, Trad: Trade, transportation, utilities, Inf: Information, Fin: Finance, Prof: Profession, business, Educ: Education, health, Leis: Leisure, hospitality, Oth: Other services, Gov: Government

Chapter 6

Summary and Conclusions

In comparison with national economy, regional economy tends to have a larger impact from economic shocks. Regional economy often shows more severe economic fluctuations than the nation as a whole. New York State suffered more severe downfalls during economic recessions of 1991 and of 2001, compared to the national standard. Employment rates in New York State exhibit rapid falls during recessions. On the industry level, declines in employment in the manufacturing sector are quite conspicuous. To understand these rapid economic fluctuations in the regional economy of New York State better, the main concern of this paper is to examine the employment of New York State at the industry level, decomposing them into industrial components. To be specific, the paper examines the inter-relationship between New York State employment and that of the US.

Determinant of employment growth: To this end, the paper first analyzes the determinants of employment growth using cross-sectional analysis of 51 states. As the determinants of employment growth, the paper shows that foreign demand, domestic demand and incentive of lower wage benefit well explained employment growth at the state level. This suggests that export growth may explain employment growth with the same magnitude as the domestic demand potential. The estimation results explain employment growth well through foreign demand, domestic demand potential, and state incentive of the beginning year. State employment growth is driven almost equally by both foreign demand and domestic demand, and the states with lower wage benefit more in employment growth through recovering after the 2001 recession.

New York State's strength in manufacturing industry: The paper, then,

examines export growth in New York State using shift-share analysis, showing that as one factor affecting state employment growth, export would have increased in each region had it grown at the overall national rate of 28.5 %. The analysis suggests that the industry mix effects appear as the main source of regional competitiveness in export growth. New York State benefited from having an industrial mix made up of more industries that were growing fast relative to the industrial mix in the country as a whole. Export in 13 manufacturing sectors out of a total 21 is proved to grow faster than at the national level. The paper, thus, examines export effect on sectoral fluctuations as an alternative specification. Given the basic analysis, it examines trade-related factors affecting employment fluctuations in New York State. Adopting the model of supply and demand, seemingly unrelated regression is estimated with trade-related factors such as the relative exchange rate, the consumer price index of urban consumers, national unemployment rate and sectoral employment. Trade-related structure of each industry is depicted in terms of relative exchange rate and the consumer price index.

Common trend between US and NYS employment: The paper next examines the relationship between New York State and US economic fluctuations by decomposing common trend and cyclical components with VECM. The unit root test for co-integrating relationship between NYS and the US indicates a single co-integrating relationship between NYS and US employment , suggesting that NYS and US employment appear to have common trends. It is shown that when aggregate employment of New York State is too high, it quickly adjusts toward the national level.

Sectoral fluctuations of New York State employment: The paper finally analyzes sectoral fluctuations in New York State employment with various VAR models. In examining the sectoral sources of employment fluctuation in New York State, the main inquiries are the contribution of each sector to regional employment,

the role of regional export, and the possible interaction between sectors. One of the difficulties in identifying sectoral sources arises from possible interplay between different industrial sectors. This paper firstly assumes that there is no interaction between industrial sectors, and then analyzes alternative models with industry interaction. For the sectoral model without industry interaction, this study uses a VAR model, assuming the hierarchical nature of the variables. With US aggregate shock as the baseline, it analyzes whether orthogonal US industrial and New York State aggregate shocks also affect fluctuations in employment growth of New York State industry. Accordingly, it is assumed that US variables have a contemporaneous causal influence on state variables, but not the reverse; and that aggregate variables have a contemporaneous causal influence on industry variables, but not the reverse. Given this analysis, the paper suggests several findings. First, NY State shocks are more important than US shocks in the determination of NY State employment. Among them, NY State sectoral shocks are the most influential in explaining the fluctuations of NY State employment, with NY state aggregate shocks running second. NY State sectoral shocks account over 80 % of employment fluctuation. NY State aggregate shock has the most explanatory power only in the trade, transportation and utility sector and other services sector.

The contributions of local sectoral shocks decrease as time goes by. Although the relative contribution of US shocks after 60 months is still far short of NY State shocks, in the longer run, the contribution of national shocks gets bigger. In the short run, the contribution of NY State shocks to the NY State employment fluctuations matter the most.

Export's role in promoting New York State economy: Second, the early regression results that analyze the determination of employment growth in terms of domestic and export sectors suggest the relative importance of the export sector in

employment growth across 51 states for the period of 2001-2005. Because the analysis was performed at the interstate level, it may be difficult to compare directly with the result for New York State alone. However, the traditional role of export in promoting economic growth is not denied in the case of New York State, because export is indeed more influential at the time of economic growth before 2001.

In sectoral analysis of New York State employment, export shocks account for a certain amount of every sector's employment fluctuation, with increasing effects as time goes by. Their role in explaining the NY State employment fluctuation, however, is relatively small. Rather than export, the period of time chosen turned out to be more crucial in the analysis. In other words, the contributions of each sector to NYS employment are very different according to the time period chosen. If the time period is divided into before and after the 2001 recession, the importance of US shocks gets larger after the recession. The contribution of NYS sectoral shocks falls conspicuously in manufacturing, education and health, information, government, and finance sectors after the recession. For example, in the education and health sector, the contribution of NYS sectoral shock falls from 91% to 59%, and the contribution of US sectoral shock increases from 5% to 12.3% after the recession. The role of export also shows different patterns depending on the period of time chosen. The contribution of export tends to increase when the time is split, regardless of which time period it is. However, comparing before and after the recession, export is more influential in the period before 2001 than in the period after 2001. After 2001, there are no sectors for which the shock of export explains over 15 %.

Minority of Cross-industry effect to the New York State' fluctuations: Thirdly, the cross-industry effect does not significantly affect the analysis. The main implication of analysis is similar: when cross-industry effect is considered using input-output coefficient, NY sectoral shocks contribute about 33% of state

employment fluctuations, and US aggregate shock explains only 7.2% to 13.1% of New York State employment.

Expansion of US influence on NYS after 2001 recession: Finally, the manufacturing sector explains 3.3% of New York State total employment in the shorter run, and 3.1% in the longer run. Among industrial sectors, the manufacturing sector receives a larger impact from US manufacturing shock; US sectoral shock explains 11.7% of NYS sectoral employment fluctuations in the shorter run, and 15% in the longer run. The contribution of NYS total employment is 6.2% in the short run, and 7.4% in the long run, and that of US total employment is 2.9% in the short run, and 3.6% in the long run. When NYS export is considered, the contribution of NYS total employment increases to 15.2% in the short run, and 16.4% in the long run. One interesting feature of manufacturing employment of New York State is that it behaves differently depending on the time period chosen before and after 2001 recession. In this sector, regional sectoral shock explains 84% of the variance before economic recession (1996-2000), while it explains 50% of the variance after recession (2001-2006). The contribution of national manufacturing shock increases from 12% to 35% after recession, implying that overall declines in the manufacturing sector become an important factor explaining NY State manufacturing employment after recession, as well as declines in total NY State employment. When NYS export is considered, the results are similar. NYS sectoral shock explains about 80% of the variance before recession, while it explains 42-38% of the variance after recession. The contribution of national sectoral shock conspicuously increases from 1.7% to 42% after recession.

One interesting finding of the sectoral analysis with NYS export is that, contrary to the analysis of New York State export growth, New York State export does not explain much of NYS manufacturing employment fluctuations. It contributes

only 0.7% in the short run and 0.6% in the long run, and the contribution of NYS export decreases from 8-9% to 4% after recession (2001-2006).

To sum up, sectoral analysis of NYS employment is more sensitive to the time period chosen than to addition of NYS export effect and cross-industry effect. Comparing before and after recession, national shock becomes more important after recession than before recession. This is more conspicuous in some industrial sectors such as manufacturing, education and health, information, government, and finance.

Chapter 7

Policy implications

7.1. New York State's Effort for Regional Economy

New York State currently offers various assistance and financial incentives to attract businesses and to boost regional economies. For example, several assistance programs are available for eligible manufacturing firms, such as Empire State Development's Manufacturing Assistance Program (MAP) and Industrial Effectiveness Program (IEP). MAP encourages manufacturers to invest in projects that will increase productivity and competitiveness by providing capital grants of up to $1 million. Manufacturing firms with 50 to 1,000 workers, and with at least 30% of export beyond the region, or with at least 30% of supply to a prime manufacturer that exports beyond the region are eligible for the program. IEP offers assistance in identifying, developing and implementing improved management and production processes to enhance efficiency and promote job growth, by providing grants of up to $50, 000.

In addition, New York State utility and gas companies offer energy cost saving programs, along with technical services and capital financing to help businesses identify and implement cost-effective, energy-efficient measures. Technical services include engineering feasibility studies, technical training on energy efficient technologies, and engineering support for project financing proposals. In this chapter, I will briefly introduce NYS' tax and financial incentives for businesses, and the empire zone program, and make a few policy suggestions.

7.1.1. Tax and Financial Incentives

In order to encourage emerging technology growth and to attract businesses to the area, New York State lowers business costs, reduces regulations, offers various tax credits and exemptions, and provides flexible financing. It provides many types of financial assistance to help ease the cost of relocating or expanding.

Financial assistance is provided for acquisition of land and buildings or machinery and equipment, construction or renovation of buildings, construction or improvement of infrastructure required for new location or expansion, working capital, employee training, expanding export opportunities, and productivity enhancement. Such assistance is offered through direct loans or grants to businesses for a portion of the eligible project costs, interest rate subsidies in the form of a grant or linked deposit with the lending institution, or infrastructure assistance in the form of a loan and grant. Various kinds of businesses such as manufacturers, service providers, warehousers and distributors, research and development companies, tourism, and minority owned business are qualified.

In addition to financial incentives, New York State offers various tax credits and exemptions such as capital investment tax credits up to 5%, and research and development tax credits up to 9%. These tax credits are offered mainly to attract businesses to the certain areas such as Empire Zones.

Linked Deposit Program (LDP): To modernize facilities and to improve overall competitiveness, New York State offers low rate loans for eligible businesses. This is a public-private partnership that provides businesses with affordable capital at reduced interest rates. The bank loans are subsidized by corresponding linked state deposits. LDP provides a 2-3% savings on the prevailing interest rate for linked loans, to make borrowing less expensive. A maximum loan amount of $500,000 for four years is

offered.

7.1.2. New York State Empire Zones Program

The New York State Empire Zone program was created to stimulate economic growth through state tax incentives designed to attract new businesses to New York State and to enable existing businesses to expand and create more jobs. To participate in the Empire Zones program, a business must first be located in an empire zone, and qualify as a regionally significant project. To qualify for certification, a business must be able to demonstrate that it will create new jobs and make investments in the empire zone and be consistent with the local zone's development plan, including a cost-benefit analysis. For Empire Zone certified companies, tax benefits such as wage tax credit, investment tax credit, zone capital credits, and NYS sales tax refund are offered.

Wage tax credit: Wage tax credit is available to companies hiring full-time equivalent employees in the Empire Zone for up to five consecutive years. A wage tax credit of $1,500 per employee is offered, raised to $3,000 per employee per year for employees in special targeted groups. In investment zones, this credit is increased by $500 for workers with wages over $40,000. Unused credits can be forwarded indefinitely and new businesses that have been taxable for five years or less are eligible for a 50% refund of unused credits.

Investment Tax Credit (ITC) and Employment Incentive Credit: Investment tax credit is available to companies making an initial investment in the zone for depreciable property and equipment which is principally used in manufacturing, processing, assembly, industrial waste treatment or air pollution-control facilities, R&D or financial institutions. 10% of the eligible investment or 8% for personal

income tax filers can be taken for credit. Unused credits can be forwarded indefinitely and new businesses are eligible for a 50% refund of unused credits.

An additional employment incentive credit equal to 30% of the investment tax credit is available for each of the three years after the investment tax credit is claimed, if employment is increased when the investment is made. Unused credits can be forwarded indefinitely and new businesses are eligible for a 50% refund of unused credits.

Zone Capital Credits: A 25% tax credit is available for personal or corporate income tax payers for eligible investments in certified zone businesses, or contributions to approved community development projects. There is a lifetime limit of $100,000 in zone capital credits per contributor for community development projects and $100,000 lifetime limit in zone capital credits per investor in a direct equity investment project.

NYS Sales Tax Refund: Purchases of building materials to be used for commercial or industrial real property located in an empire zone are eligible for a refund of NYS sales taxes. A similar refund of local sales tax may also be available from the locality.

Real Property Tax Abatement: An Empire Zone may offer tax abatements from an increased assessment, with the abatement value based on improvements to real property for up to 10 years. This holds for up to seven years at 100%, decreasing over the last three years of the exemption.

Enhanced Tax Benefits for Qualified Empire Zone Enterprises (QEZE): Enhanced tax benefits such as QEZE sales tax exemptions, QEZE real property tax

credit, and QEZE tax reduction credit are available for qualified empire zone enterprises (QEZE). To qualify for them, a business must pass additional tests based on business' employment history and operations.

QEZE Sales Tax Exemptions: Qualified empire zone enterprises are granted a 10-year exemption from state sales tax on purchases of goods and services (50%) and utility services (100%) used predominantly in an Empire Zone. Telephone services are exempt if delivered and billed to the business at an address in its Zone. An exemption from any locally-imposed sales tax may also be available. The exemptions run for 120 consecutive months from the effective date on the sales tax certification issued, provided the business continues to mee the employment test each year.

QEZE Real Property Tax Credit: Qualified EmpireZone enterprises are allowed a refundable credit against business or income tax equal to a percentage of real property taxes paid in the zone. The credit is available for 10 years and unused credits may be obtained as a cash refund in the year they were earned.

QEZE Reduction Credit: A credit against business or income tax equal to a percentage of taxes attributable to the Zone enterprise is granted to qualified Empire zone enterprises. The credit is available for 10 years and can reduce a company's tax liability to zero, eliminating the alternative minimum and fixed dollar minimum tax.

7.1.3. Export Assistance

New York State provides export assistance through unsurpassed access to markets, and services and expertise for businesses starting and expanding international sales activity.

The State offers two customized services for New York exporters seeking new overseas business opportunities, the Export Marketing Assistance Service (EMAS) and the Global Export Market Services (GEMS). In addition, it offers an array of other services to boost international sales, such as in-house research, consultations with specialists on exporting products or services, seminars to help develop and hone export skills, and low cost participation in international trade shows and trade missions.

Export Marketing Assistance Service (EMAS): EMAS helps businesses find sales agents or distributors abroad. It provides businesses with a personalized, customized search conducted by professional trade staff of the state's foreign-based offices. State trade specialists familiarize themselves with a company's product line, trade experience and any other factors relevant to identifying the best possible parties to represent that company's sales interest abroad. The program is currently available in Canada, Mexico, Brazil, Chile, most of Europe, Japan, Israel and South Africa. EMAS represents an important tool for New York State manufacturers of all sizes that aim to enter or expand their sales in foreign markets. By participating in EMAS, the state finds the appropriate importers, distributors and sales agents to best represent each business internationally.

Global Export Market Services (GEMS): GEMS assists New York companies by providing matching grants for export marketing projects for new-to-export and new-to-market companies. The funds are typically used to pay for consulting services resulting in export market development plans that benefit individual companies, groups of companies or industry associations. Grants are also available for regional-based world trade or economic development organizations serving as multipliers for export assistance in their respective geographic areas of coverage.

Designed to help small and medium-sized businesses get the technical, financial and marketing assistance they need to succeed in international markets, GEMS can provide up to $25,000 in export marketing consultant services custom-tailored to a company's specific international business development needs. Groups of companies or industry associations can request up to $50,000 to fund export trade development services. GEMS covers up to 50% of the total acceptable project costs within the maximum funding described.

GEMS funding can be used for a variety of activities designed to help company expand internationally. These activities include (1) identifying and assessing overseas market; (2) developing comprehensive market entry strategies on a country-by-country basis; (3) researches; (4) recommending and developing appropriate distribution channels; (5) developing timely, product-specific competitive market intelligence; (6) assessing export operations and fulfillment capacity; (7) training staff in export operations; (8) creating new international marketing materials; (9) developing after-sales support or service for foreign markets; and (10) adapting product to meet overseas market specifications.

In order to qualify for the GEMS program, companies must either be a New York State manufacturer, service or agricultural business with 500 or fewer employees and whose New York State production content is at least 51%. The program is also open to educational institutions and regional non-profit organizations, such as world trade groups that develop innovative programs to help New York State firms expand their exporting skills and activities.

Export Counseling and Education (Export NY): New York State offers customized assessments and technical assistance to help improve the export skills of current exporters, and provide new global trading skills to manufacturers and services

firms seeking to enter the export market. Export NY is a specialized CEO training program designed to improve a company's export skills. Conducted weekly over an eight-month period, Export NY brings together various resources to focus on issues ranging from international financing and strategic marketing plans to distributor contracts and differing business cultures. The program includes formal academic instruction, lectures from international industry participants, service training, and one-on-one consulting on the development of an international business plan.

7.2. Policy Suggestions

7.2.1 Regional Competitiveness with industry mix

The findings of this dissertation suggest several policy implications for New York State. The analysis shows that New York State benefited from having an industrial mix made up of more industries that were growing fast relative to the industrial mix in the country as a whole. In New York State, it turned out that industry mix is important factor for the competitiveness of regional industry. This implies that policy makers need to give more attention to industrial mix in New York State. Keeping relatively strong industry composition, economic development policies should focus on enhancing regional industry competitiveness to other states. It is therefore of interest to find out which policies should be emphasized to improve regional competitiveness under the current strength from a good industry mix.

Currently, state and local economic development policies are judged by the number of jobs that come into NYS for the first time under the Empire Zone program. Empire zones have become important economic development tools, providing competitive advantage, attracting investment and creating jobs. Such benefits may need to be extended to all counties that do not currently have one. Counties without Empire Zones stand little chance of attracting new businesses or keeping major

expansion projects. For example, some companies may consider relocating to particular region, but the ability of those regions to offer incentive packages that are competitive with the neighboring states such as New Jersey and Connecticut are currently limited.

NYS has endeavored to attract high technology companies. This would be advantageous because such companies tend to have relatively high-wage employment and long-term growth potential with high growth rates. In addition, high-technology companies are often export-oriented. By attracting high-technology businesses to the area, NYS can generate economic activity that yields tax revenues in excess of public service expenditures and can use fiscal surplus to lower tax burdens for existing residents. Thus, extending empire zones which offer more flexibility in location would be beneficial for the state. However, too often state and local economic development policies are judged by the number of jobs that come into NYS for the first time. For example, incentives provided through the Empire Zone program allow new businesses to potentially operate in a tax-free environment.

Most future NYS growth may come from businesses that are already there. Business retention is rarely seen as a priority objective in NYS policy. ax and financial incentive programs have been shaped to meet this objective rather than to assist those already there. Businesses that have made a commitment to NYS over the years, and that are not growing now, must suffer a high state and local tax burden. This is especially true for 21,000 manufacturers in NYS, which employ 641,000 workers. The existing manufacturing sector has lost 16,000 jobs, representing 40% of the nation's loss in manufacturing employment during that same time. According to the survey of manufacturers in NYS conducted by the federal reserve bank of New York (January of 2007 and 2008 consequently), manufacturers identified NYS' high tax rate as a heavy burden in doing business. Extending tax benefits to existing

businesses and retarding those industries in the state may be required to boost regional sustainable economies.

7.2.2 Manufacturing and Eexport Iindustry in NYS

In most regional economies, cyclical instability is a result of a non-diversified industrial base. This is particularly true where most jobs are in capital goods and durable goods manufacturing industries, since the demand for these products closely follows the business cycle. To stabilize regional fluctuations over the business cycle, incentives might be targeted to industries less affected by the business cycle, such as services, or to those that might complement existing industries, in the sense that their employment and output tend to move counter-cyclically.

Currently in NYS, however, not much favorable treatment id offered on an industry basis; most tax benefits and financial incentives are location-based. Policy makers may need to consider favorable treatment for a particular industry on the basis of other criteria than location. For example, they may consider giving favorable tax treatment to export industries and industries that relatively faster. The resources required for such tax treatment could be obtained from the saved resources that used to be spent on structurally-growing industries showing greater increases in employment growth both in recession and during times of economic recovery.

This dissertation classifies structurally declining industries, structurally growing industries, and cyclical industries. It shows that education and health is one distinguishingly growing sector, as are government and other services. It is interesting that these structurally-growing industries are mostly in public sectors. On the other hand, the manufacturing sector is classified as a structurally-declining industy because it experienced decline in both recession and economic recovery. The New York State manufacturing sector showed more employment loss during economic recovery than

national standard, calling for more special attention. In the case of the service sector, which is cyclical (ie., falling employment during recession and rising employment growth during economic recovery), policy makers should try to maintain the strength of the sector.

Since the portion of export-based industry is relatively smaller than the domestic goods industry, a higher rate of tax credit on export-based industries may be effective in terms of money spent. As described in the previous section, NYS offers tax credits and financial incentives as forms of subsidy mainly to stimulate local economy by attracting businesses into regional areas, and export assistance to help international sales activity. There is no favorable rate of tax credit or lower interest offered by the state for export-based firms, except existing international marketing assistance.

This dissertation shows that export in 13 manufacturing sectors out of a total 21 has grown faster than at the national level. It shows that chemical, primary metal, machinery, computers and electronics, transportation and miscellaneous manufactures comprise more than 80% of NYS' export. New York State may consider stimulating those particular industries by allowing higher tax credit, lower interest rate, and longer period for such benefits. In sum, it may need to profile the highest rate of tax credit on export-based firms and structurally-declining industries, as it does for q ualified Empire Zone enterprises.

7.2.3 Risk Sharing between US and NYS

New York State does not have to fully absorb any economic shocks on its own; it can share them with other states. In other words, NYS can share risk with the rest of US. It has been shown that there is a direct relationship between employment in NYS and the US. When aggregate NYS employment State is too high, it quickly

adjusts toward the national level. Also, the influences of NY State shocks are more important than the national shocks in terms of affecting the NY State employment. However, the rate of national shocks became more important after the 2001 recession. Nonetheless, this still reflects the low degree of risk sharing in NYS, which is not a desirable outcome. For stabilization of the regional economy, therefore, the state needs to explore ways to increase the degree of risk sharing at least similar to that in most other states.

Some studies (Juben(2006), Kim et el(2005)) suggest specific measures for risk sharing. For example, by holding a portion of ownership of a company in an other state, New York State can smooth economic shocks caused by variations in NYS production. By facilitating trade between states, New York State can diversify income sources and region-specific risk. Further risk-sharing between New York State and the US can be achieved by the fiscal transfer program, which intends to redistribute income from persistently rich regions to persistently poor regions. Federal grants that are generous to poor states may turn out to have stabilizing effects since they may smooth adverse economic shocks by securing disposable income of the state.

The necessary steps to facilitate risk sharing between NYS and the rest of the US include, among others, policies to stimulate trade both inter-state and with foreign countries. The provision of social networks and other physical infrastructure to facilitate such trading activities should be high in the agenda.

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